STEAM PADDLE TUG
EPPLETON HALL

Historic Structure Report

1990

DRAFT

San Francisco Maritime National Historical Park

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Prepared for

The San Francisco Maritime
National Historical Park
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The Historic Documents Department
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of the San Francisco Maritime National Historical Park

(1966)

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Introduction

EPPLETON HALL, the only remaining intact example of a Tyne River paddle tug, rests at her moorings at the Hyde Street Pier, seemingly abandoned. She is the last major vessel to be acquired by the San Francisco Maritime National Historical Park and is the only one that has not yet received preservation treatment.

For the Maritime Park, EPPLETON HALL is problematic in more than one sense. She does not fit into the Park's theme of West Coast maritime history and is the only vessel of the fleet to be rejected for inclusion in the National Register of Historic Places. Her previous use, as a semi-operational vessel that occasionally steamed on the Bay, came to an abrupt end in the late 1970s due to safety concerns.

EPPLETON HALL is, nevertheless, a historically significant vessel, a direct descendent of the first craft to go into commercial service as harbour tugs. Not only is she worth saving as an industrial artifact, she holds important information about the evolution of seafaring that should be passed on. As she sits today, she is neither being saved nor interpreted.

In this historic structure report, a plan is outlined for restoring and interpreting EPPLETON HALL. The plan is not overly ambitious; it seeks to achieve the minimum level of preservation that is befitting a vessel of EPPLETON HALL's significance. Unavoidable in any discussion of the treatment for EPPLETON HALL is the question of whether the Maritime Park is the appropriate aegis for the paddle tug. The answer is beyond the scope of this report. This lingering question, however, should not be cause for withholding from EPPLETON HALL the attention she so rightly deserves.

Management Synopsis

The Steam Paddle Tug EPPLETON HALL is one of seven vessels in the collection of historic ships at the San Francisco Maritime National Historical Park. She was acquired through donation in 1979 and is the last major addition to the fleet. EPPLETON HALL's significance lies in the fact that she is the only intact example of a type of steam paddle tug that was common to the Tyne River region of England, an area credited with the initial development of the tugboat. She has no direct connection to the maritime history of the West Coast or the United States.

To date, EPPLETON HALL has not been developed as an exhibit, nor has she been preserved. At present, she lies moored off the Hyde Street Pier, dormant and in a state of progressive deterioration.

The treatment proposed in this report calls for immediate stabilization of the EPPLETON HALL's condition, to be followed by a six-year program to fully restore her and open her to the public as a permanently moored floating exhibit. Estimated costs for the treatment are as follows:

Stabilization and Planning		$ 70,000
Restoration:	Phase 1	$ 121,500
	Phase 2	$ 134,500
	Phase 3	$ 133,000
	Phase 4	$ 189,000
	Phase 5	$ 105,000
	Phase 6	$ 57,000
Total Cost of Proposed Treatment		$ 810,000

EPPLETON HALL's status as an internationally significant historic resource justifies her restoration and long-term preservation. If such treatment is deemed beyond the purview or resources of the Maritime Park, deaccession to a worthy organization is recommended.

1-1. Administrative Data Section

1-1.1. Project Identification

-- To be produced by San Francisco Maritime NHP Staff --

1-1.2. Proposeed Use of the Structure

-- To be produced by San Francisco Maritime NHP Staff --

1-1.3. Justification for Such Use

-- To be produced by San Francisco Maritime NHP Staff --

1-1.4. Recommendations for Preservation of the Work Products of this Study

-- To be produced by San Francisco Maritime NHP Staff --

2-1. Physical History

2-1.1. Historical Background

EPPLETON HALL is a Tyne paddle tug, a type of vessel that was developed for towing oceangoing sailing vessels, primarily coal colliers, to and from the the port of Newcastle on the river Tyne river. The Tyne tugs were steam sidewheelers characterized by coal-fired boilers and side-lever engines. "There were once well over 200 examples of paddle tugs afloat on the Tyne, Wear, and Tees rivers -- all in the northeast of England. They ranged from single-engine wooden hulled versions built in the main before 1870, to twin-engine iron-hulled types constructed between 1870 and 1900, with steel being used principally for the few that were built in this century.

"The design of tug which EPPLETON HALL typifies had its heyday between 1875 and 1884 when over 70 were built for United Kingdom registration. After this time the screw tug began to compete strongly, though paddle tugs continued to be used because their light draft and/or maneuverability frequently outweighed the disadvantage of limited thrust and float vulnerability" (Neale 1969).

1818?

The first tow boats used for towing ships went to work in 1918. One of these was the Perseverance on the Tyne. Within three years, there were thirteen other steam paddle tugs operating on the Tyne. "The reason", writes maritime historian Karl Kortum, "is not far to find." London was heated and illuminated by coal from Newcastle carried by a vast fleet of collier brigs. By "taking steam" at the mouth of the torturous Tyne, these sailing vessels could save days working up the river to their loading points by use of wind and tide alone. In fact, with the coming of steam, the average number of round voyages to London each year increased from eight to fourteen.

"The idea spread. Paddle tugs first made their appearance in Hull in 1821, in Sunderland about the same time, in Liverpool in 1826, subsequently in Montreal, and in London in 1832" (Kortum 1979). The Tyne paddle tug represents one of the first commercially viable uses of steam propulsion in ships, and the seminal beginning of tugboating worldwide. EPPLETON HALL was one of the last to be built and is the only intact example remaining.

2-1.2. Sources of Documentation

EPPLETON HALL's physical history spans three distinct periods:

1914 to 1967	Period of commercial service on the Wear and Tyne rivers of northeast England.
1969 to 1979	Period of use as a yacht.
1979 to Present	Period as a museum ship under caretakership of the National Park Service in San Francisco.

Almost all of the known source material relevant to EPPLETON HALL's physical history is in the hands of the Historical Documents Department of the San Francisco Maritime National Historical Park. Documentation of the vessel's origins and working history (1914 to 1967) is limited, and consists primarily of photographs, and oral histories and correspondence from former crew. Copies of the drawings she was built from exist, as do the construction drawings of the present boilers, which were installed in 1946. Most of this material was collected by those who took part in the restoration of the vessel in England in 1969.

Documentation of EPPLETON HALL's period as a steam yacht (1969 to 1979) is fairly complete, and consists of records of the restoration undertaken in 1969, and records kept by The Friends of the EPPLETON HALL Society, a nonprofit organization that maintained and operated her in the 1970s.

Documentation of EPPLETON HALL's museum ship period is also fairly complete, and consists of surveys, dry dock contracts, and museum correspondence and memoranda.

2-1.3. Chronology of Physical History

Period of Service as a Commercial Tug: 1914-1967

EPPLETON HALL's working history began with her launching in 1914 and ended with her retirement and subsequent sale to a scrapyard in 1967. She operated on the river Wear for most of her working career, spending only the last few years in ~~the Tyne~~ Seaham Harbor.

1914 Construction and Launching

The EPPLETON HALL was built by Hepple William and Company of South Shields, England for the Lambton and Hetton Collieries Ltd., and named after the Lambton family's ancestral home (Neale 1969). The details and exact date of her launching are ~~not known~~. The original construction drawings for the vessel (SFMNHP Col.#555, Recs. #1758 and #1760) identify her as hull "No. 632", with dimensions of 100' x 21' x 11' molded. Official measurements in the 1914 edition of Lloyds Register of Ships are slightly different, giving her a length of 100.5', breadth of 21.1', and depth 10.8' (a minor discrepancy between as-built and design dimensions is not uncommon, as ship's hulls were, and still are, rarely built to precise tolerances). The Register lists her tonnage as 166 gross, 153 under deck, and 27 net. Her port of registry is given as Newcastle and she is under the British flag.

EPPLETON HALL's original drawings give the following materials specifications:

Hull: all-riveted steel construction
Main Deck: 5" x 2-1/2" pitch pine, with 1/4" steel under planking over boiler space, and teak margins
Bridge Deck: yellow pine
Bulwarks: oak stanchions, American rock elm cap rail (bulwark planking not specified).
Paddleboxes: English oak "sweeps", elm "cleading"

Machinery was specified as "2 Sets Side Lever, Jet Condensing, 30" dia. x 51" stroke; 2 Boilers, Common Flue."

The EPPLETON HALL's boilers were coal-fired and her coal bunkers could carry "45 to 60 tons which lasts for four days, but she did not run all the time" (Halverson 1983). Her stack was painted "black with three red bands, the insignia of the Lampton Collieries" (Neale 1969).

Lloyds Register makes no mention of an electrical system, indicating that the tug was built without one.

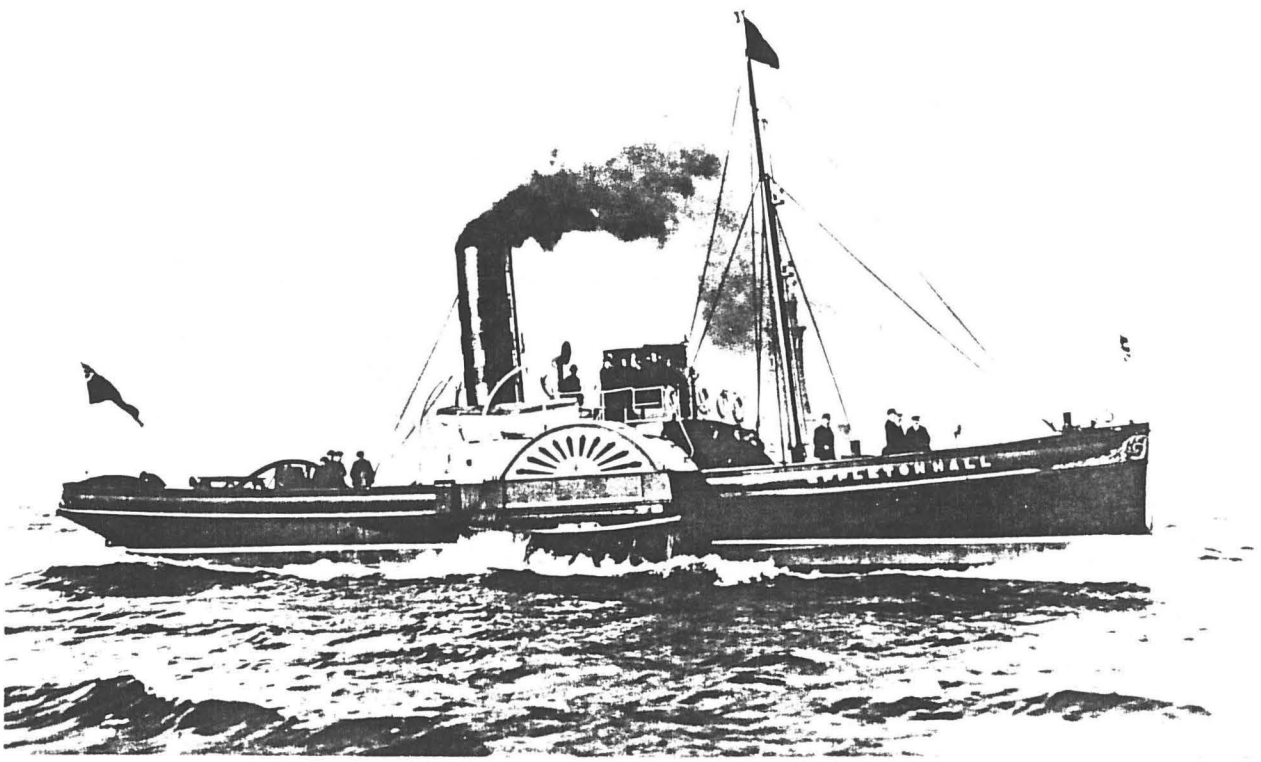


Fig 1. EPPLETON HALL steams on her sea trials in 1914.
Photo: SFMNHP I7.23,738

1914 Sea Trials

A photograph of EPPLETON HALL during her sea trials in 1914 (SFMNHP Photo #I7.23,738) shows a steam paddle tug almost identical to the existing vessel, though the following differences can be seen:

- The aft bulwarks are wood; they are now steel.
- There is a pair of davits for each boat, rather than the current single davit for each.
- The aft skylight has a elegant round top with glass panes and appears to be of wood. The current skylights are utilitarian steel boxes with peaked tops.
- There is a post at the bow with a swivel towing hook mounted on it, The towing hook, or one like it, is still aboard the vessel today, but the post has been removed.
- The mast is a finely tapered spar, indicating that it is wood, rather than steel, as is the current mast. ~ Restored 2000

1946 Boilers Replaced Move after 1945

By 1946, EPPLETON HALL's original boilers had worn out. They were replaced with new boilers constructed by Riley Boilers Limited of Stockton-on-Tees, England. The new boilers were of the original "Tyne tug style" and were similar, if not identical, to those installed in 1914. The boilers were hand forged in the traditional fashion and were the last of this type of boilers built in England (Owen 1976).

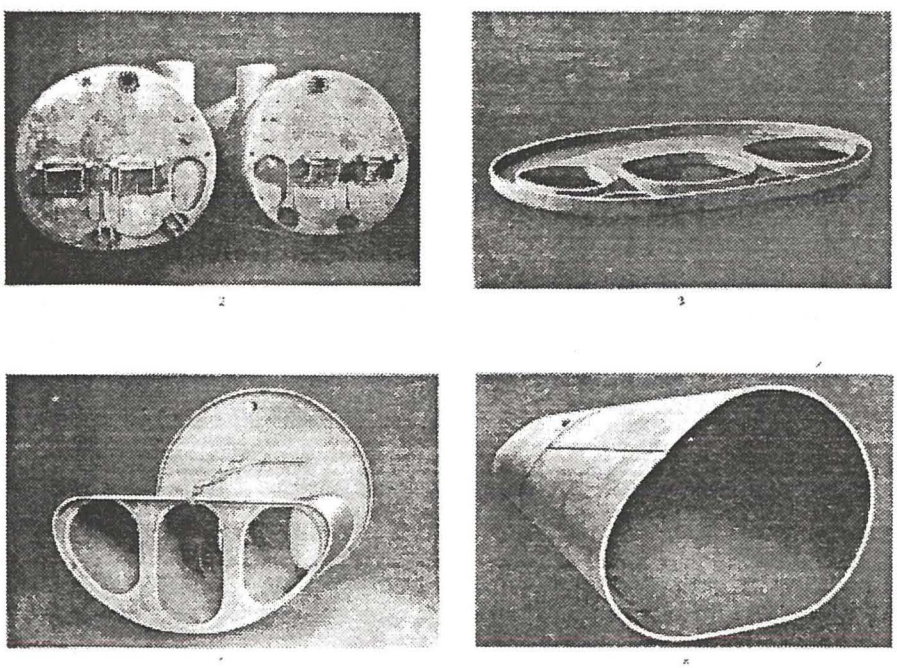


Fig 2. An advertisement by Riley Boilers, Ltd (ca. 1946) showing the boilers they built for EPPLETON HALL in 1945-46.

1947 Ownership Assumed by The National Coal Board

In 1947, the National Coal Board took over all colliery interests from Lambton, Hetton & Joicey Collieries, including their paddle tugs.

~~Ca. 1952~~ Ownership Assumed by France Fenwick, Tyne & Wear Co.

~~Around 1952~~, France, Fenwick, Tyne & Wear Company, Limited took over ownership of EPPLETON HALL from ~~the National Coal Board~~. At that time, the stack was painted in the company colors: black top, white bottom, with an insignia in the middle consisting of a blue anchor with vertical blue stripes on either side (Neale 1969).

Ca. 1952 Modifications for Passenger Certificate

Shortly after her acquisition by France Fenwick, EPPLETON HALL was modified for carrying a limited number of passengers. "This conversion was so that the EPPLETON HALL could attend newly launched steamers, that is, pick up passengers and officials after a new steamer had run the measured mile (performed sea trials) out in the North Sea" (Robson 1968).

Modifications included extending the engine room fidley (the steel house over the engine room) aft by about 5'. A set of large hinged doors on the after end of the original fidley were eliminated in the process, and new access doors were installed, port and starboard.

The engine room combings in way of the doors were raised to 18". The wooden aft bulwarks were replaced with steel ones, and short stanchions were installed on top of the bulwarks, with wire railings mounted 8" above the bulwark cap rail. After these modifications were made, EPPLETON HALL was certified to carry twenty passengers.

Ca. 1914-53 Pilothouse Altered

A historic photograph dated ~~1953~~ ~~(SFMNHP #I1.24353)~~ shows the top of her pilothouse to have been removed. The panelled wood sides remain, but they only extend up to the former window sills. This step was probably taken to improve the helmsman's visibility, particularly looking aft, but also would have left the helm exposed to the weather. This alteration was made sometime between 1914 and ~~1953~~.

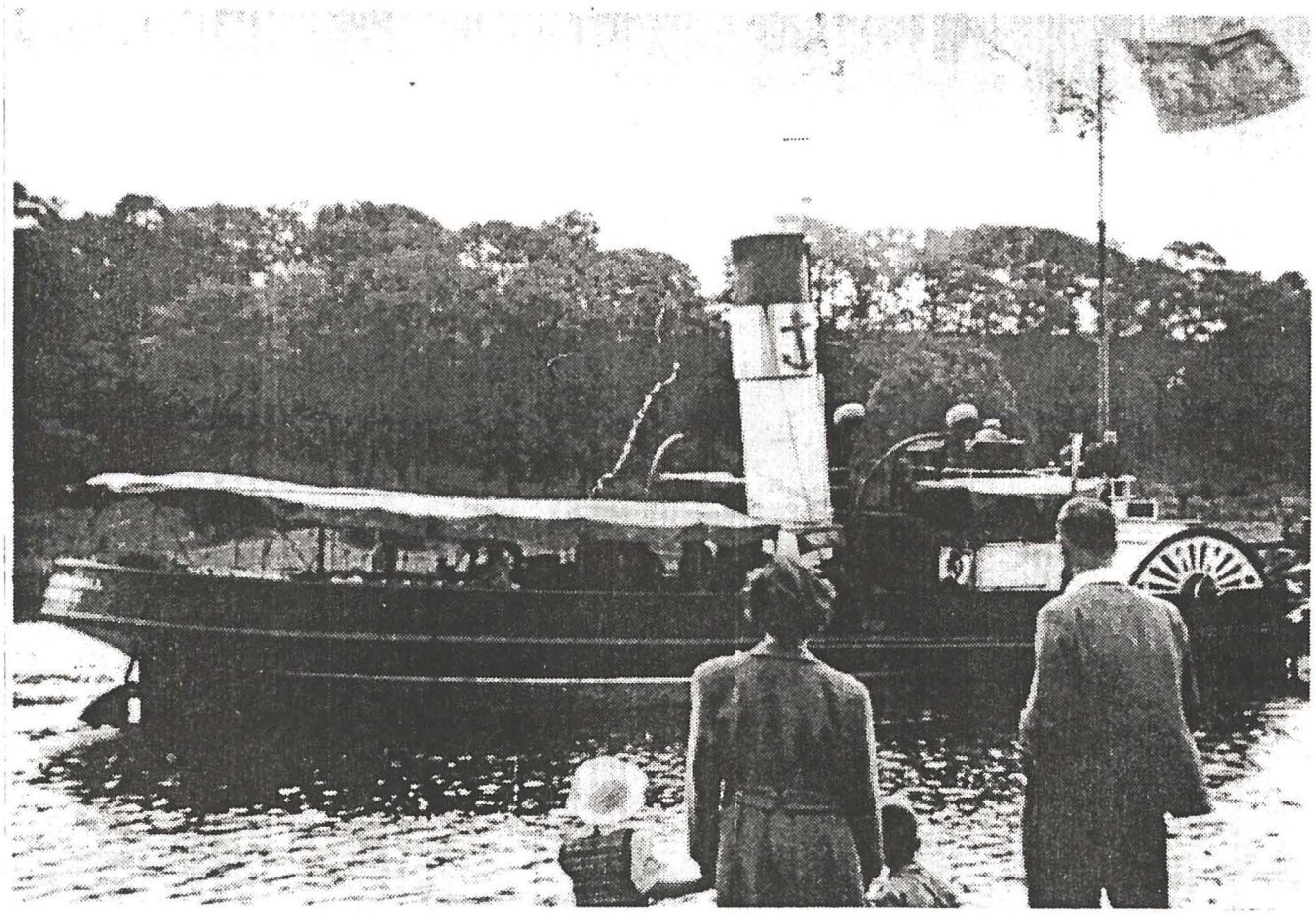


Fig. 3. EPPLETON HALL, ca. 1950s, wearing the France, Fenwick, Tyne & Wear stack insignia. Note removal of pilothouse top.
Photo: SFMNHP I7.23521

Nov
1964 Ownership Assumed by Seaham Harbour Dock Company

After nearly fifty years of service on the Wear river, EPPLETON HALL was purchased by the Seaham Dock Company and moved to Seaham Harbour ~~at the mouth~~ south of the ~~Tyne~~ Wear River.

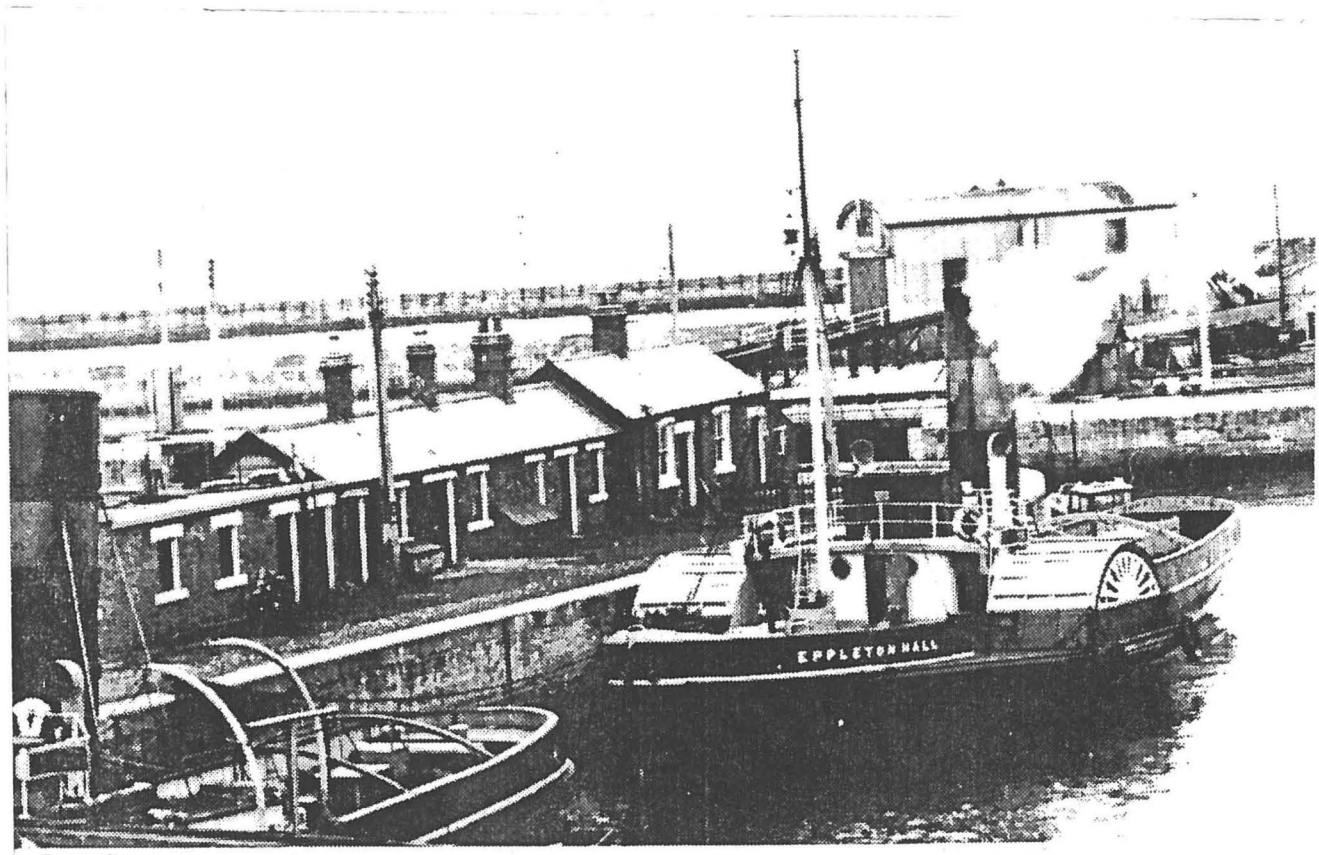


Fig. 4. EPPLETON HALL at Seaham Harbour, 1967.
Photo: SFMNHP I1.23463

1967 Sold for Scrap.

In 1967, EPPLETON HALL was sold to the scrapyard of Clayton & Davy, at Dunston on Tyne, thus ending her working career (Featherston 1970). From 1967 to 1969, she lay on the mud bank awaiting scrapping. During this period, the wood after deck and the wood interior of her after compartment were completely burned away.

B. Period of Use as a Yacht

This period extends from the major reconstruction work done in England in 1969, prior to EPPLETON HALL's transatlantic crossing, to the accession of the ship to the National Park Service in 1979.

1969 Extensive Rebuild.

In 1969, EPPLETON HALL was purchased by Scott Newhall of San Francisco and underwent a major rebuild at the shipyard of R. B. Harrison Co., Ltd. on the Tyne (Newhall 1971). The primary emphasis of the rebuild was to prepare the vessel for a transatlantic voyage. Much of the work was not intended to be historically accurate, though many of the vessel's prominent features were preserved or restored. Numerous modifications were also made. Collectively, this work comprises the most dramatic change the vessel has undergone since her launching. The following is a summary of the work performed in 1969. A detailed accounting of the work is given in a list compiled by the shipyard (R. B. Harrison Co. 1969).

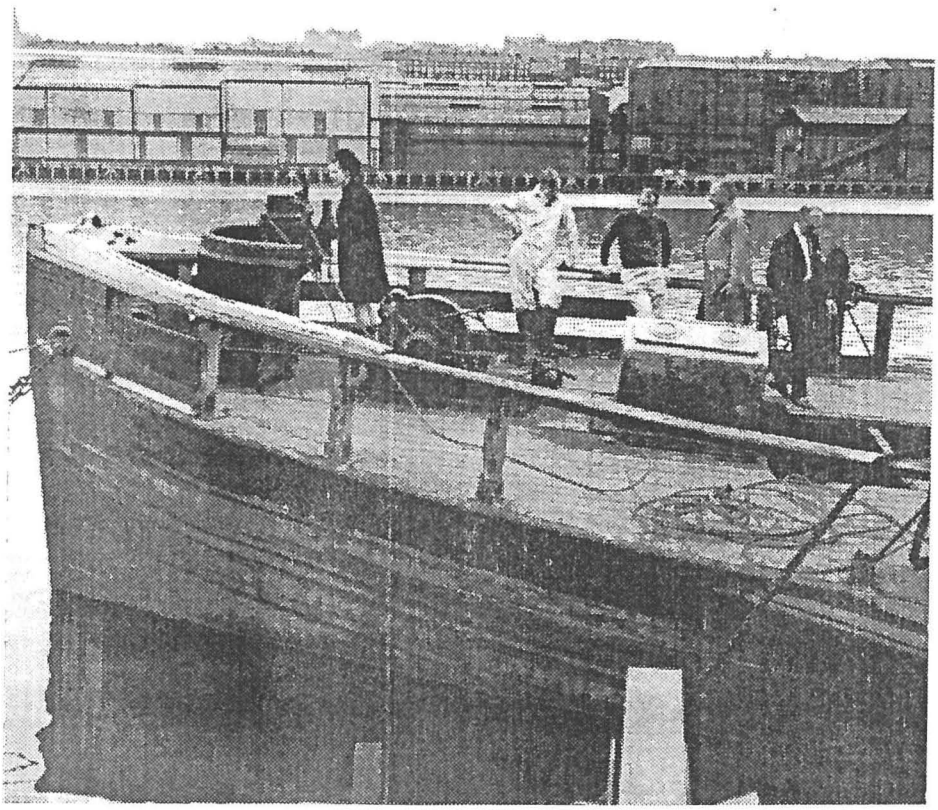


Fig. 5. Scott Newhall and company surveying their acquisition at Clayton and Davy scrapyard in 1969. Note the "towing table" at the bow, an original item removed during the rebuild. The windlass and skylight were restored and are aboard today. Photo: SFMNHP Ill.23,999#79

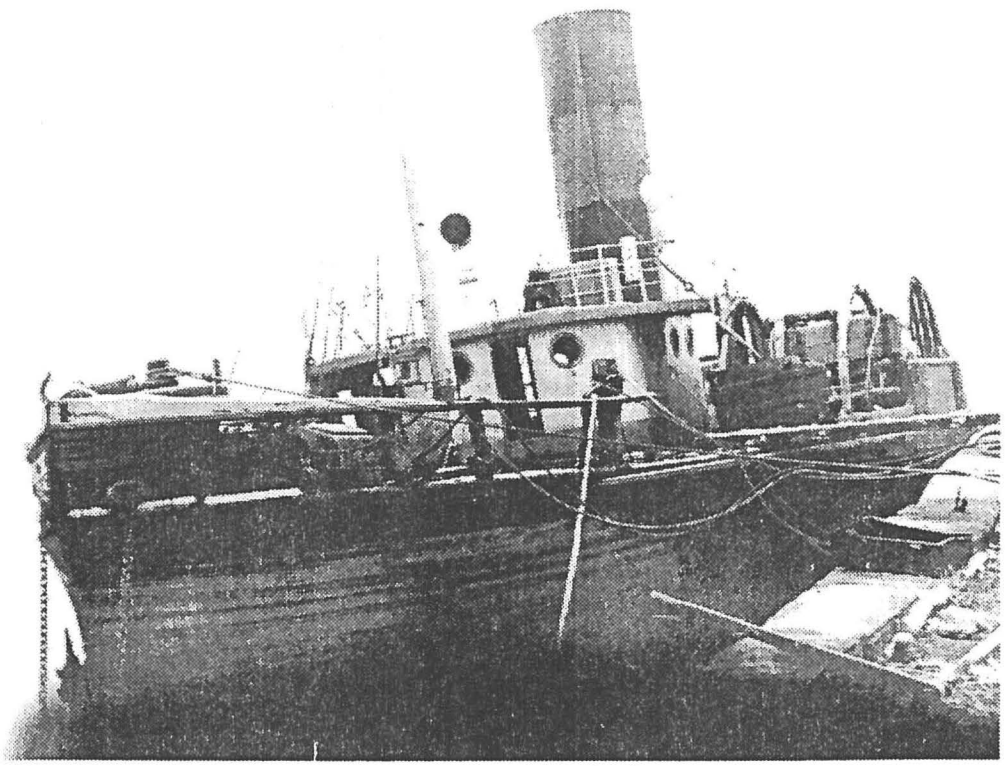


Fig. 6. Sunk at the Clayton and Davy dock, 1969.
Photo: SFMNHP I8.23723

Restoration and Preservation Work Completed in 1969

- Hull: Approximately 100 sq.ft. of plate inserts were installed, primarily in D strake. Numerous small doubler plates were fitted at various locations on the shell, and welded repairs were made to some of the frames. The hull interior was cleaned, scaled, and coated with "grease paint."

- Engines: Both engines were disassembled and overhauled, including the main cylinders, slide valves, air pumps (2), and bilge and feed pumps (2 each). Bearings were overhauled and adjusted. Oil boxes with lube oil feed pipes were fitted to all major bearings to allow automatic, rather than manual, oiling.

- Boilers: The boilers were overhauled, including renewal of most partition stays, rejointing several of the mountings to the boiler shell, repair of manhole studs, and renewal of balance pipes. The boilers were then relagged (insulated) and hydro-tested to 53 p.s.i. All copper steam pipes was annealed and tested. New pressure and vacuum gauges were installed.

- Paddleboxes and Sponson Decks: The boxes were rebuilt, including renewal of steel "sweeps" and all wood sheathing. The steel paddlebox bulkheads were repaired, scaled, and painted. The sponson decks fore and aft of the paddleboxes were rebuilt, including repair and renewal of rub rails.

- Paddleswheels: Paddlewheels were rebuilt, including renewal of all wood paddle floats, renewal or restoration of steel radius arms, rims, and stays, and overhaul of all bronze bearings.

- Skylights: Both fore and aft skylights were removed, repaired, and reinstalled.

- Bulwarks: The forward bulwarks (wood) were rebuilt to near original configuration. The aft bulwarks (steel) were repaired.

- Other: The existing steering gear, control linkages, and rudder were overhauled. The historic windlass was overhauled. Sea valves (4) were overhauled. New teak ladders were installed, replacing existing ladders to bridge deck and accommodations. The oak forward towing bar was renewed in kind, using the existing stanchions; the aft towing bar was replicated. The existing brass steam whistle was restored.

Modifications

- Boilers: In addition to the repairs cited earlier, the boiler were converted for oil-firing by removing the two coal boxes from each boiler and installing an oil burner in the center fire box.

- Fuel Tanks: Fourteen fuel tanks were installed, most of them inside the engine room. The aft ends of the coal bunker bulkheads (steel) were cut out, port and starboard, and several fuel oil tanks installed inside the bunkers. Another tanks was installed beneath the forward accommodation's sole. An existing feed water tank on the aft engine room bulkhead was cleaned and converted to a fuel tank.

- Pumps: Two diesel-powered fuel pumps were mounted on platforms aft of the engines. The existing steam "donkey pump" was rebuilt.

- Deck: The steel deck structure in way of the wood decking was significantly altered by the addition of several deck beams, stringer plates, and foundation plates. This work reflects an alteration of the original deck layout. All of the deck beams in the aft deck were renewed (the original beams had been damaged when the aft end was burned out). The wood deck planking was renewed and several deck prizms added, fore and aft.

- Scuttles: New wood scuttles (companionways) to the fore and aft compartments were installed to replace the original scuttles that were missing. These scuttles, which exist today, are not to the original design and are positioned fore and aft, rather than athwartships as the original ones were. Another scuttle, a steel one, was added at the forward end of the engine room. (removed in 1995 overhaul)

- Accommodations: The compartments fore and aft of the engine room were completely stripped out and rebuilt, including all joinerwork. The layout of the compartments was altered to suit the needs of the owner and is not historical. (removed in 1995)

- Chain Locker: A chain locker was built beneath the forward accommodations sole.

- Pilothouse: The pilothouse, missing at the time of purchase, was replaced with a teak one salvage from a fishing trawler. Two engine room telegraphs and a ship's wheel were installed. A railing and access ladder were added to the house top. (removed in 1995)

- Rig: A sailing rig was installed. The wood foremast was replaced with a steel mast fitted with a square yard. A steel mizzen mast was added and rigged with a boom and gaff. (removed circa 1975)

- Davits: The original boat davits (two per side) were missing and were replaced with a single davit each side.

- Electrical System: A diesel generator and wiring system was installed. (removed)

Historic Fabric Removed

- Coal Furnaces: The historic coal furnace fronts were removed from the boilers and disposed of, as were the internal fire bars and bridges.

- Forward Towing Table: The towing table, a heavy steel mount for the bow tow hook, was removed and disposed of. The tow hook was salvaged and is still aboard the vessel.

- Accommodations: The joinerwork in the forward accommodations was scrapped.

- Foremast: The existing wood foremast was scrapped.

- Other: Existing wood flooring in the engine room was scrapped and replaced with steel plates. The coal bunker flooring and "shifting boards" were scrapped, as were the six coal scuttles (round manholes for loading coal through the deck above the bunkers).

Following completion of the rebuild in September 1969, EPPLETON HALL was steamed to San Francisco, via the Panama canal, arriving at the Golden Gate in March 1970 (The remarkable story of the paddle tug's voyage is told in Newhall's book "The Eppleton Hall").

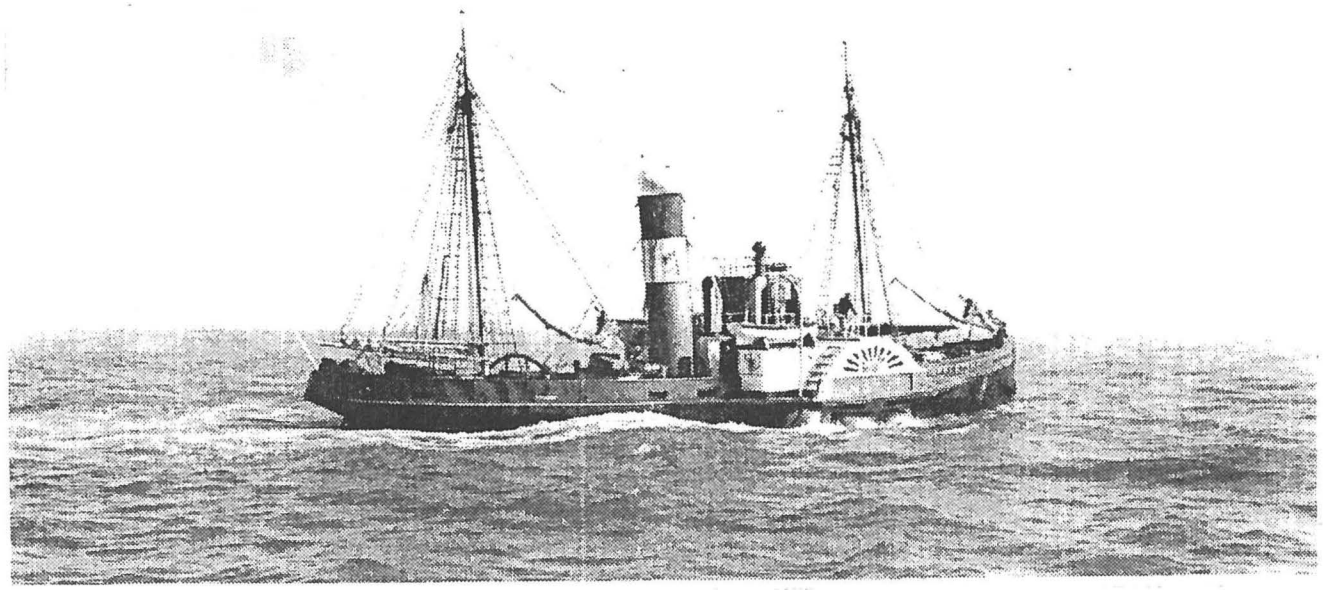


Fig. 7. March 1970, EPPLETON HALL approaches the Golden Gate, nearing the end of her voyage from the Tyne.
Photo: SFMNHP J7.25141

1970 Maritime Museum Association Assumes Ownership

In October 1970, EPPLETON HALL was donated to the San Francisco Maritime Museum Association (Nelson 1970), and was subsequently maintained and operated by The Friends of the EPPLETON HALL Society, an volunteer organization formed in 1975. She was registered with the California Department of Harbors and Watercraft, and given the official number "CF 1642 ER."

1971 Coast Guard Certification

In 1971, Eppleton Hall was certified by the U.S. Coast Guard for operation as a steam yacht on San Francisco Bay and tributaries, with a maximum capacity of 48 people. Numerous requirements had to be met in order to achieve certification, most relating to safety equipment. Alterations to the vessel included conversion of all fuel tanks to water ballast, except the one on the aft bulkhead, and modification of the bilge pumping system to allow redundancy.

1971-79 Drydockings, Maintenance, and Modifications

Correspondence, periodicals, and other records kept by The Friends of the EPPLETON HALL Society indicate that the vessel was drydocked for Coast Guard inspection and routine maintenance in 1973, 1975, and 1978. There are no details of work performed, though it is not believed that any major work was performed that would have impacted historic fabric.

Photographs taken in the early 1970s show that, shortly after her arrival in the Bay, her mizzen mast and foreyard (nonhistoric) were removed.

Records also indicate that numerous minor alterations were made by volunteers during this period. These were mostly directed at the improving the fuel delivery system installed in 1969.

C. Period as a Museum Ship.

EPPLETON HALL's period as a museum ship began with her donation to the National Park Service in 1979 and extends to the present. Relatively little physical change has occurred during this period, with exception of her general deterioration.

1979 National Park Service Assumes Ownership

EPPLETON HALL was donated by the National Maritime Museum Association to the Maritime Museum of the Golden Gate National Recreation Area, National Park Service, on 23 August 1979.

1983 Drydocking

EPPLETON HALL was hauled out at Pacific Dry Dock in Oakland and the bottom, topsides, and paddle wheels were sandblasted and painted. Thru-hull valves were removed, inspected, and tested (Hull and Cargo 1982).

1987 Collision Damage

On 16 September 1987, the fishing boat GOLD'N'STAR accidentally rammed EPPLETON HALL, which was moored at Aquatic Park Lagoon. The impact stove in the forward port sponson deck and rub rail. Damaged was estimated at $5,800 (Tri-Coastal Marine 1987).

1987-1990 Stabilization Work

Since 1987, an effort has been made, both by volunteers and Park staff, to stabilize deteriorating fabric on the vessel. Most of the work has been limited to maintenance steps which, unfortunately, have not appreciably slowed the vessel's rate of deterioration. Although no significant alterations have been made, some historic items have been disassembled and are at risk of being lost or damaged.

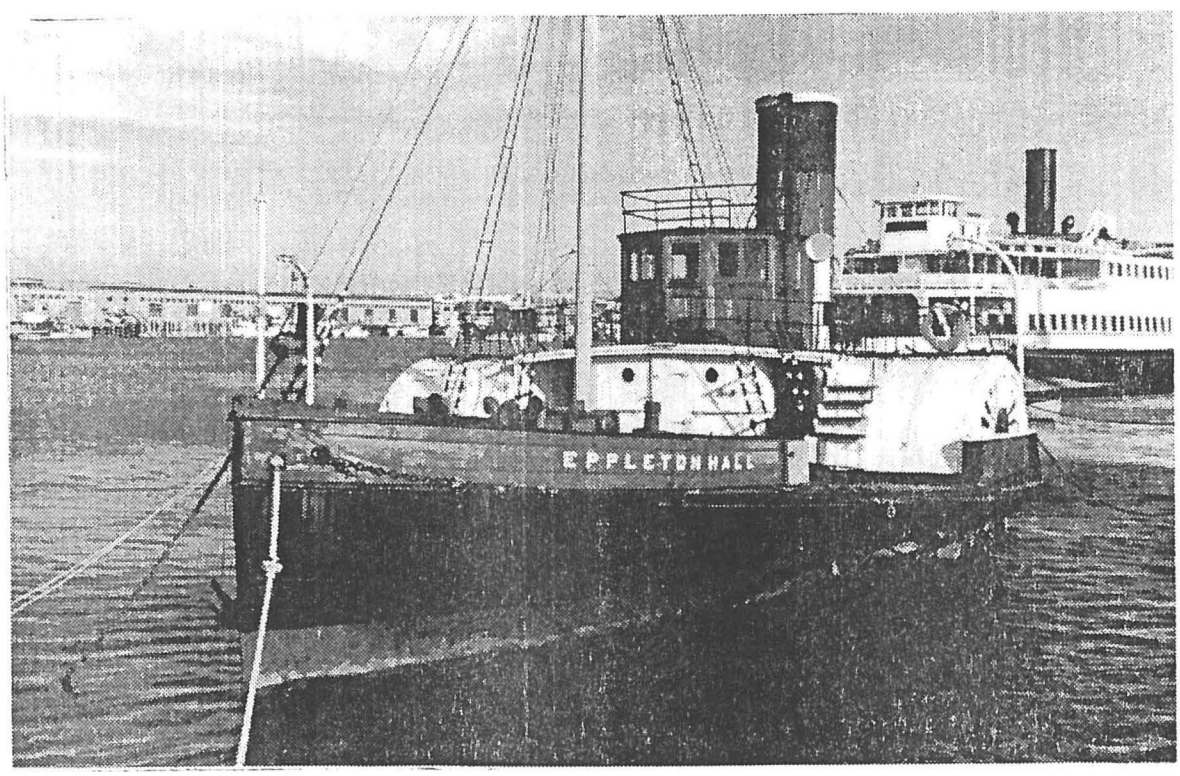


Fig. 8. Moored at Hyde Street Pier, SFMNHP 1990.
Photo: Tri-Coastal Marine

2-2. Existing Condition

2-2.1. Particulars

Length overall	100 ft. 6 in.
Depth molded	10 ft. 10 in.
Beam molded	21 ft. 1 in.
Beam maximum	33 ft. 3 in.
Net tonnage	27
Gross tonnage	166

Hull	riveted steel
Decks	wood, steel amidship
Superstructure	wood and steel
Machinery	twin side lever "Grasshopper" steam engines
Boilers	two oil-fired (originally coal-fired) boilers

2-2.2. General Arrangement and Construction

EPPLETON HALL is essentially an intact example of a Tyne paddle tug, although some nonhistoric alterations have been made. These alterations, and the impact they have on historic integrity, are discussed in section 2-3, Significance of Fabric and Features. The following is a general description of the vessel as she is today. The existing condition drawings in section 2-4.1 provide additional detail.

Hull and Deck

The hull is riveted steel with a single deck. The deck is wood planked, forward and aft, and plate steel in the midship areas, the steel plate being added over the boiler room during her later working period (heat from the boilers probably have made it difficult to keep the wood deck watertight in this area).

Solid bulwarks run the length of the deck, fore and aft of the paddle boxes. The bulwarks and stanchions forward are wood, while those aft of the paddle boxes are now steel -- another modification made during the tug's service life. The paddle boxes and sponsons are of composite construction, with a steel framework and inboard bulkhead, and wood sheathing on the top and outboard sides.

A steam anchor windlass is mounted on the forward deck, near the bow. Abaft the windlass is the steel galley skylight and ventilators, followed by a wooden scuttle that leads to the forward accommodations. The steel foremast is located aft of the scuttle, and aft of the mast, another scuttle, this one leading to the engine room. This second scuttle is steel and is located to starboard of centerline.

The steel engine room fidley (which looks like a deckhouse) is located amidships, leaving a narrow passage between the paddle boxes on either side. Aft of the fidley is a low steel

trunk that houses the stack uptake. The stack rises from the trunk with a slight rake aft. Just aft of the trunk is an arched strongback supported by two wood posts, for guiding the tow line clear of the deck structures. The tow hook, the point at which the towline is made fast to the tug, is located at the base of the stack.

Abaft the boiler area, the wood deck resumes. Located on the aft deck is a wooden scuttle that leads to the aft accommodations. A steel skylight and ventilators for the accommodations are aft of the scuttle. At the stern is a set of steel bitts, and the rudder head and tiller. A wood grating covers the tiller area.

Outboard of the hull, and attached to the paddle boxes fore and aft, are triangular wood gratings or sponson decks. Abaft the paddle boxes and on the sponson decks are steel deckhouses for bosun's locker and heads. EPPLETON HALLS's boats were carried in chocks over these houses, and handled by a single radial davit on each side. The boats are no longer aboard.

A wood bridge deck, enclosed by a steel railing, extends from the top of the fidley to the tops of the paddle boxes, port and starboard. The pilot house, a small teak paneled structure, is located atop the fidley.

Below Decks

Below decks, the hull interior is subdivided by three steel watertight bulkheads which are located at frames number 3, 14, and 47 (counting from forward with the stem as frame 0). The bulkheads divide the hull interior into four spaces: forepeak, forward accommodations, engine room, and aft accommodations. The forepeak, between the stem and the collision bulkhead at frame 3, appears to have always been a void space.

Abaft the collision bulkhead is the forward accommodations. This area is a reconstruction, with all of the wood joiner work and furnishings dating from 1969. Forward is a small pantry or storage area fitted with thwartship shelves. Two small hatches in the accommodations deck give access to the steel chain locker in the bilge below. Next aft is the galley, with a small coal-burning stove to port, and a counter along the forward and starboard sides. Abaft the galley are two single-berth cabins, port and starboard. Between the cabins is the short passageway and access ladder to the scuttle on deck. Below the cabin sole is a fuel oil tank. Access to the bilge is through a small hatch beneath the access ladder.

A watertight bulkhead at frame 14 separates the forward accommodations from the engine room. The two side-lever engines are located side by side at the forward end of the engine room. The engines are surrounded on the port, starboard, and forward sides by steel bulkheads that form the coal bunkers. The U-shaped space between these bulkheads and the hull would have originally held coal, but is now filled with an

odd assortment of free standing fuel oil tanks that were installed prior to the vessel's transatlantic voyage in 1969.

Abaft the engines are the two saltwater scotch boilers. The boilers, which are now modified for oil firing, are replacements dating from 1946. Abaft the boilers there is a fuel oil tank integral with the after engine room bulkhead at frame 47.

Abaft the bulkhead are the after accommodations which, like those forward, are a reconstruction. The access ladder to deck descends into a short passageway with the captain's cabin to port and the chief engineer's to starboard. The passage opens into a small saloon with pilot berths port and starboard and a large shelf across the stern.

At the aft end of the saloon, is the aft peak bulkhead. The tiny area of the counter abaft this bulkhead appears to be a void space.

Machinery

The machinery arrangement is unusual in that the boilers are abaft, rather than forward of, the engines. This placement was dictated by the need to keep the paddlewheels as close as possible to midship in order to achieve the maximum maneuverability.

The two independent single-cylinder engines are vertically mounted, as are the air pumps and feed pumps that drive off the engine via a beam or lever. The engines are jet condensing, with some feedwater being recovered from a hotwell and the rest sent overboard in way of the paddlewheels.

Aside from the pumps that are integral with the engines, most auxiliary equipment dates from the post-historic period. This includes small diesel-powered pumps and generators, and various fuel and water valves and strainers.

2-2.3. Summary of Physical Condition

The following is a summary of vessel condition based on survey of EPPLETON HALL in 1990. For a more detailed analysis of condition, see Section 3-1. Survey Findings.

Hull

The condition of the hull is fair to poor above the waterline, with numerous areas of local corrosion and wastage. Condition of the hull bottom is not known. The exterior shell was last sandblasted and painted 1983, and the coatings are probably at or beyond their effective life span. Comparison the internal ultrasonic gaugings with those taken during the 1983 survey do not show any significant loss of shell plate thickness, but thirteen percent of the gaugings were under .200 inch. This is considered a marginal thickness and represents a potential threat

to watertight integrity. Thin areas of shell plating should be addressed at the next drydocking.

The interior shell condition varies greatly. The hull in the area of the accommodations is entirely sheathed with wood and could not be thoroughly inspected. Partial removal of the sheathing revealed that the shell has been coated with a soft film preservative that has largely been effective in preventing corrosion. The shell in other areas, including the chainlocker, bilges, and engine room, is suffering from severe ongoing corrosion. The worst area is in the engine room, where the side shell is wasting away behind the fuel tanks, an area that cannot be accessed for maintenance, and in the bilges where sea water is constantly sloshing over the shell plates and frames. This condition is resulting in a rapid deterioration of significant historic fabric.

Decks and Superstructure

The wooden decks have leaked badly ever since the initial restoration in 1969. The forward deck can be stabilized in the short term, but requires such extensive repair that renewal is considered the best long-term option. The aft deck is probably still salvageable. Renewal of decks should be closely coordinated with other restoration work, such as removal of fuel tanks, that can only be accomplished while the deck is removed.

The wood bulwarks are partially rotten and will require at least some renewal for long-term preservation. The bridge deck and pilot house are repairable, but the paddle boxes and sponson decks are mostly rotten and require major renewal of wood and steel elements. The steel fidley is in fair condition, with only local incidents of corrosion. The stack shows extensive wastage along riveted seams and will require extensive repairs to effectively arrest deterioration.

Machinery and Equipment

The vessel last steamed in 1979 and the machinery has not been properly laid up or regularly maintained since that time. As a result, the engines are frozen and exterior surfaces are rusting. The engines appear intact and complete, but true condition cannot be determined without disassembly and internal inspection.

The boilers were inspected in 1983 by Hartford Steam Boiler Co., and considered condemned unless major repairs were undertaken. The extent and cost of repairs were not determined at that time.

Much of the auxiliary equipment and piping is either missing or is disassembled. What equipment remains appears to be in poor condition, including the two diesel auxiliaries. All twelve of the non-integral fuel, lube oil, and water tanks are heavily corroded and covered with rust scale. All valves and sounding pipe plugs are frozen, at least for hand operation. The contents and internal condition of the tanks have not been determined.

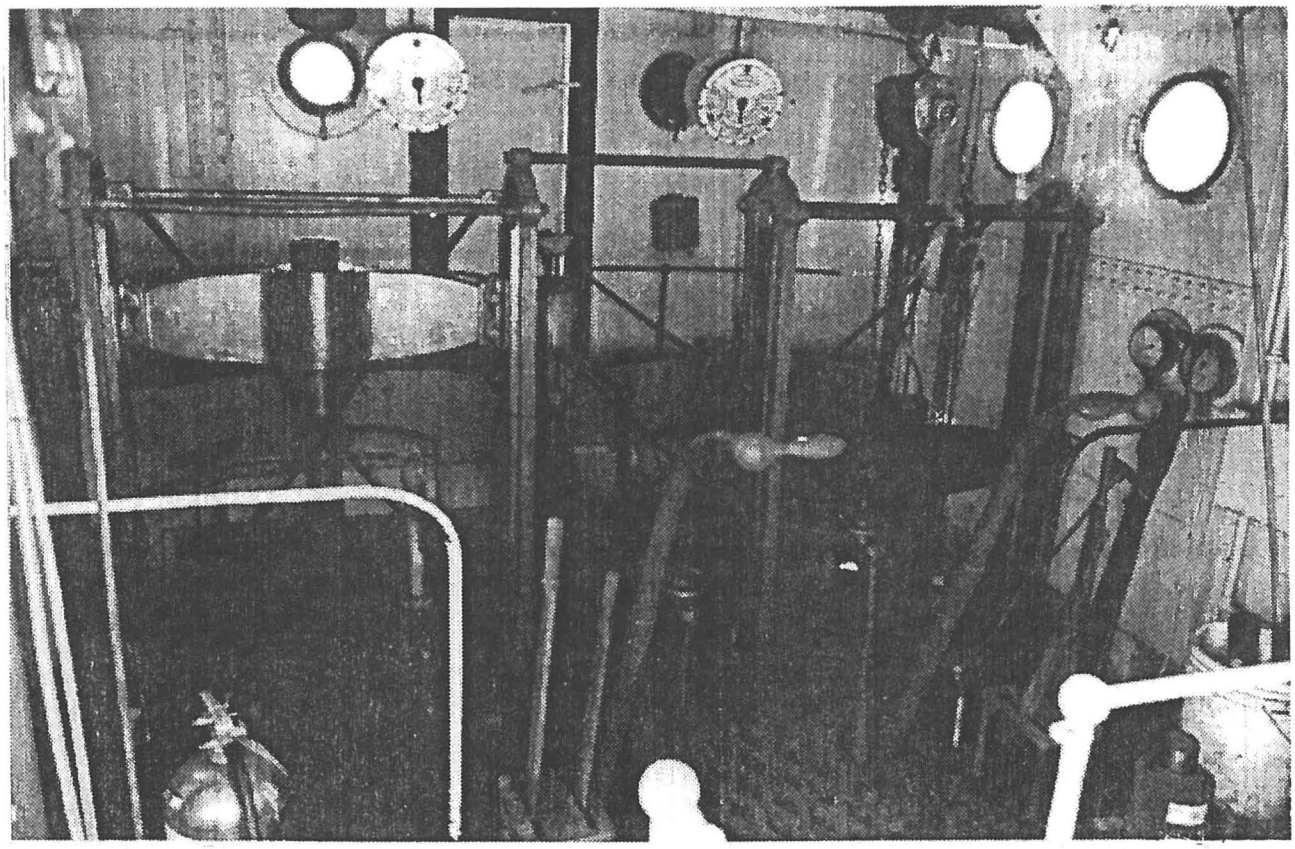


Fig. 9. Top of engines as viewed from the upper engine room flat inside the fidley. The port piston rod (seen at left) is near the top of its stroke. The chainfall above the starboard piston rod is evidence of attempts to free the frozen cylinders.

The anchor windlass is intact, but has been partially disassembled and is rusting away. The steering gear is also intact and shows similar signs of neglect.

The paddlewheels were sandblasted and painted in 1983, and the wood paddle buckets renewed. The steel paddle frames and feathering mechanism are generally intact, but a substantial amount of material has been lost to corrosion over the years and deterioration is ongoing.

The tubular steel mast appears to be in fair condition, but the shrouds are heavily corroded and the ratlines are rotten and unsafe.

Much of the vessel's electrical system is seriously deficient and is considered unsafe. An attempt to upgrade the electrical system was made in 1987, with the addition of a new distribution panel and disconnect switch.

Conclusions

EPPLETON HALL's overall condition is poor, and she appears to be deteriorating at a rapid rate. Her present state is due primarily to inadequate preservation, insufficient maintenance, and the relentless effect of the marine environment.

Although she retains a considerable degree of historic integrity, her integrity has been compromised by nonhistoric alterations, most of which were made during the 1969 rebuild. Many of these alterations now increase the difficulty of preserving original fabric, particularly the hull.

EPPLETON HALL's condition has already deteriorated to the point where nothing short of an extensive restoration can adequately preserve her. Recent efforts to stabilize her condition appear to have had little effect on the rate of deterioration. The vessel is not in immanent danger of becoming a total loss, yet she is continuing to suffer irreparable damage to significant historic fabric. At present, the greatest threat to the vessel is the ongoing corrosion of the underwater hull which, if not arrested, will eventually result in loss of watertight integrity, thus increasing the risk of sinking.

2-3. Significance of Fabric and Features

2-3.1. Overall Significance

EPPLETON HALL's historical significance lies primarily in the fact that she is the last remaining Tyne paddle tug. She is significant to the Tyne river region of England and, do to the important role these tugs played in the transport of coal from the region to the rest of England, she can claim national significance in the area of commerce. The fact that she embodies many early technological developments in the evolution of marine steam transportation gives her internationally significance.

2.3.2. Rating of Elements

The various component parts of EPPLETON HALL have been rated according to the degree to which they contribute to the overall historic significance of the vessel. They are rated as highly significant, significant, or nonsignificant and are assigned a "Historic Treatment Rating" from the NPS Inventory Condition Assessment Program (ICAP) specifying an appropriate range of treatments.

Highly Significant Elements

The following elements are original fabric or features that are major contributors to the historic character of the vessel as a Tyne paddle tug. Most of these elements have historic significance that extends beyond the individual vessel or its type. Most of elements have an Historic Treatment Rating of "1", specifying preservation regardless of condition.

Engines: EPPLETON HALL's engines are arguably her most significant feature. The side-lever or "grasshopper" engine, a relatively primitive type of machinery first developed in England in 1828, is said to be the first commercially viable steam propulsion device for vessels, both oceangoing and harbor craft (Nicoll 1977). Side-lever engines were a characteristic feature of Tyne paddle tugs, and EPPLETON HALL is the last intact vessel with this type of machinery (Brouwer 1985). The engines have not been significantly altered since their installation in 1914, and retain a high percentage of original fabric.

Boilers: Although the existing boilers are not original -- they were manufactured and installed in 1946 -- they are of an extremely archaic type and are believed to be almost identical to those installed in 1914. They are coal-fired, fire-tube boilers designed to operate on salt water (an anomaly among boilers) and at a very low pressure (35 p.s.i.). This type of boiler was referred to as the "Tyne tug boiler" due to its close association with Tyne paddle tugs.

The existing boilers were made specifically for EPPLETON HALL by one of the oldest boiler makers in England, Riley Boilers,

Limited. They were largely hand forged, a process dating back to the beginning of the industrial age and anachronistic by 1946. In 1969, after the historic period, the boilers were converted to oil-firing, resulting in the loss of the coal furnaces. Otherwise, they remain largely as built. EPPLETON HALL's boilers were the last of their type made (Hutton 1976), and may well be the last in existence. As with the engines, they represent an important era in the evolution of steam propulsion, and therefore have a significance which transcends the vessel itself.

Hull: The hull is significant in terms of fabric, method of construction, and form. The hull remains essentially unaltered and retains a large percentage of original fabric. In terms of shape and dimensions, it is characteristic of the later iron and steel hulled Tyne paddle tugs. The method of construction of the hull -- a particular type of riveted shipbuilding known as joggle-plate construction, wherein the hull plates are bent, or "joggled" to lap over each other -- is a now-rare example of shipbuilding practice of the era. Though not common in the United States, this system was used extensively in Britain and Europe in the first half of this century.

Paddlewheels: EPPLETON HALL's "feathering" paddlewheels are a feature characteristic of Tyne paddle tugs. The intricate feathering mechanism that varies the angle of the paddle floats represent a final evolution in the development of the paddlewheel as a form of marine propulsion. The existing paddlewheels were extensively rebuilt in the post-historic but they retain their original form and a number of original parts.

Significant Elements

Apart for the items listed as highly significant, all fabric or features that are original, or were added or modified during the historic period (1914-67), are considered significant, regardless of their prominence. Features that were restored or replicated in the post-historic period are considered significant if they retain their original form and method of construction. These items are given an Historic Treatment Rating ranging from "2" to "4", specifying preservation where possible or where there is no compelling reason for removal.

Fidley: The engine room fidley is original, with exception of the aft end which was extended in the early 1950s. Some of the watertight doors are later replacements. The fidley is a characteristic feature of most larger paddle tugs, though many appear to have had wood fidleys rather than steel.

Paddle Boxes, Sponson Decks, Deck Houses, and Boat Decks: In terms of significance, these items can be considered as a unit. They have been extensively rebuilt and contain little historic fabric, but generally retain their original form.

The single davits on the boats decks are a modification -- historically, EPPLETON HALL had a pair of davits on each side.

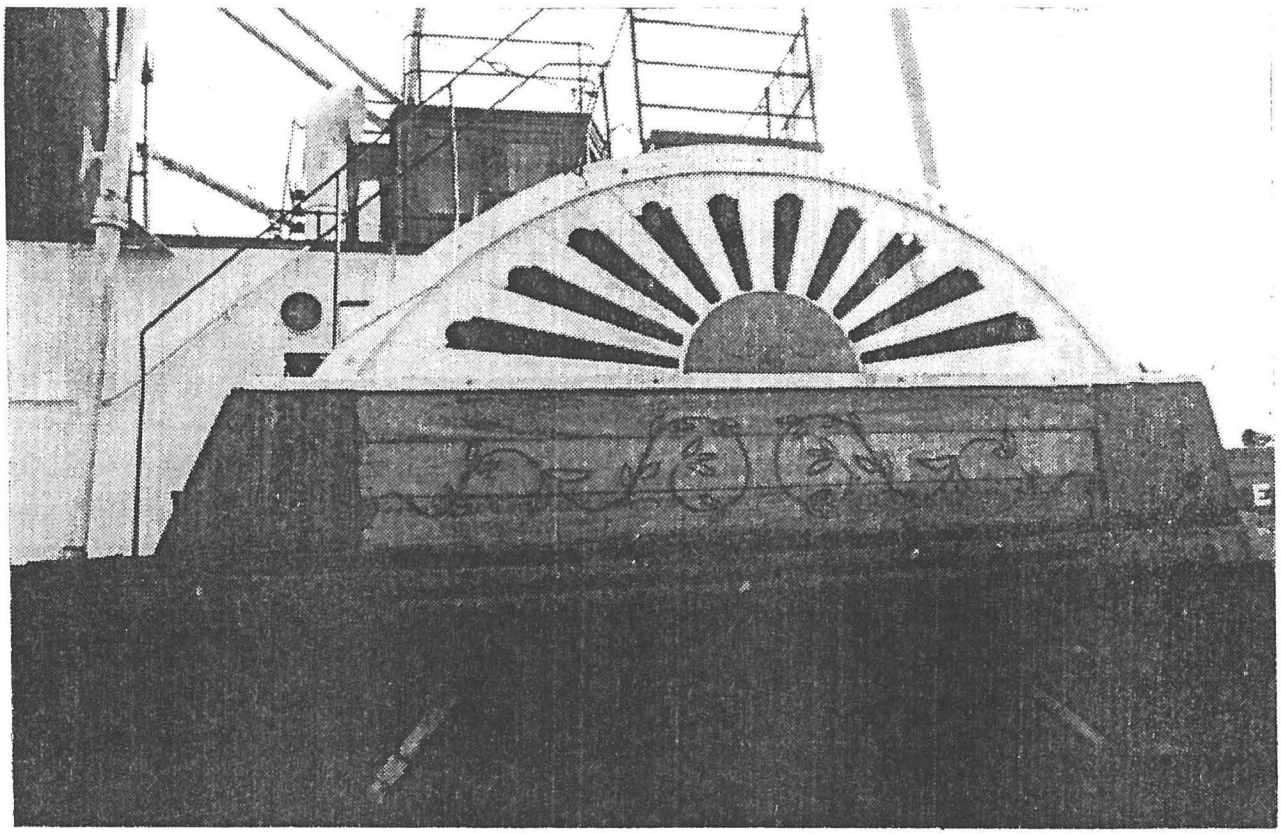


Fig. 10. The starboard paddle box, completely rebuilt in 1969, is essentially as original, with exception of details such as the addition of the scrollwork carved in the outboard side.

Bulwarks: The wooden bulwarks forward were completely restored in 1969 and contain little historic fabric aside from the steel plating at the bow and some iron fittings. They appear to be a faithful restoration of the original bulwarks and are therefore considered significant in form.

The aft bulwarks date from the early 1950s, when her original wood bulwarks were replaced with steel. They have been crudely patched in places, but remain essentially as-built.

Towing Bars: The arched towing bars on the aft deck were standard features of paddle tugs, allowing the tugs to maneuver without snagging their towing lines on deck furniture. Both towing bars appear to be faithful restorations. The turned wood posts supporting the forward towing bar are the only remaining historic fabric.

Stack and Boiler Trunk: The riveted stack and boiler trunk are historic fabric and remain unaltered. The tall stack is a characteristic feature of steam vessels, which needed the height to create draft for the boiler furnaces.

Skylights: The present steel skylights are not original, but they appear in photographs from the later historic period (the originals were wood and considerably more ornate).

Windlass and Other Deck Gear: The windlass is believed to be original, as it matches the original construction drawings. It is a now-rare example of a small steam-powered anchor windlass.

The steel bitts on the main deck and the two engine room ventilators on the bridge deck are thought to be historic items, either original or later additions.

Nonsignificant Elements

The following elements were added after the historic period and do not contain historic fabric. Some are inappropriate additions that detract from the vessel's historic integrity; others are alterations or attempts at replication. Acceptable treatment ranges from "preserve where there is no compelling reason for removal to "remove/alter/replace" (Historic Treatment Rating "4" to "6").

Scuttles: All of the existing scuttles are nonhistoric. The steel engine room scuttle is an addition, and the wood accommodations scuttles are replacements that do not resemble the original scuttles.

Pilothouse: The pilothouse was salvaged from a fishing vessel and installed in 1969. It bears a general resemblance to the original pilothouse.

Fuel Tanks, Pumps, and Piping: All of these items are additions made in order to run the boilers on diesel fuel rather than coal. They alter the arrangement and appearance of the engine room. The tanks are a maintenance liability, as they limit access to the hull interior.

Fuel Burners: The fuel oil burners were installed in 1969 and replaced the original fire boxes, which were scrapped at that time. The oil burners are out of keeping with the exclusively coal-fired Tyne tugs.

Interior of Accommodations: The original interior woodwork of accommodations is a significant feature that has been lost. Both the forward and after compartments were completely stripped out at the end of the historic period and no evidence remains of the original arrangement, other than what can be seen on the original construction drawings. The

existing woodwork is nonhistoric in terms of construction details and arrangement.

Mast: The present steel mast dates from 1969 and replaced a wood mast, which may have been the original. The mast is similar to the original in dimension, but the rigging and fittings have been significantly altered. Missing are the towing lights that would have been an essential feature of an active tug.

Ventilators: The numerous ventilators on the fore and aft deck (10 total) were added after the historic period. The vessel originally had only one ventilator on the fore deck and one or two aft. Although the existing ventilators are of a traditional type, their excessive numbers alter the appearance of the main deck.

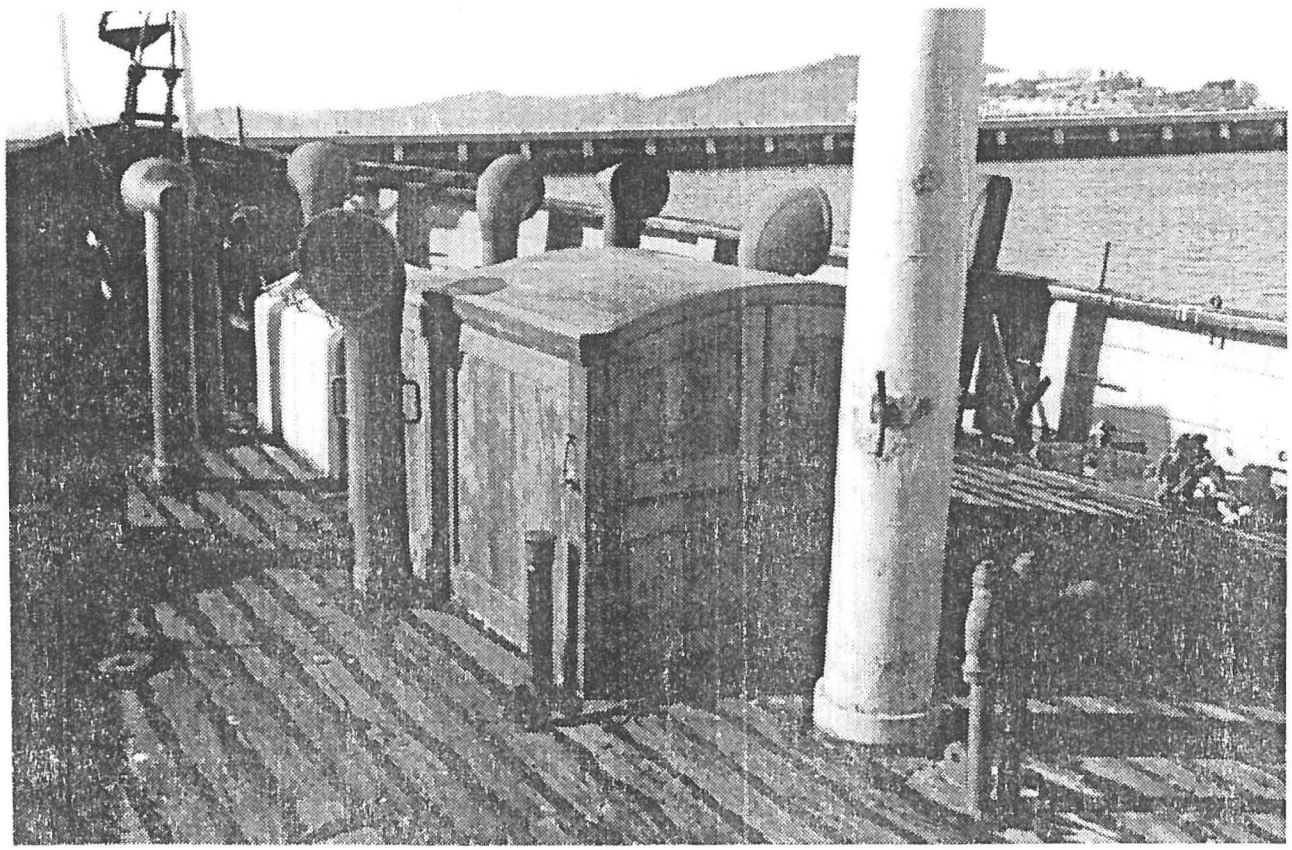


Fig. 11. The numerous cowl ventilators on the foredeck look "salty", but are not an historic feature. The rebuilt scuttle forward of the mast is in the original location, but is oriented fore and aft, rather than thwartships, as the original was.

Deck Lights: The round prizm-type deck lights in the fore and aft decks were installed in 1969. They are traditional items, but it is not known whether EPPLETON HALL was originally fitted with them.

Conclusions

Despite the considerable amount of fabric lost or altered since the end of her historic period, EPPLETON HALL retains most of her prominent features, making a full and accurate restoration not only possible, but desirable. Of immediate concern is the preservation of highly significant elements, such as the engines and boilers, which are presently deteriorating at a rapid rate. These items cannot be effectively preserved <u>in situ</u> without stabilizing and maintaining the vessel as a whole. Permanent removal of significant elements for the purpose of preservation and interpretation is not recommended. Though they would be considered valuable artifacts in any setting, items such as engines and boilers take on far greater significance in the context of the vessel as a whole.

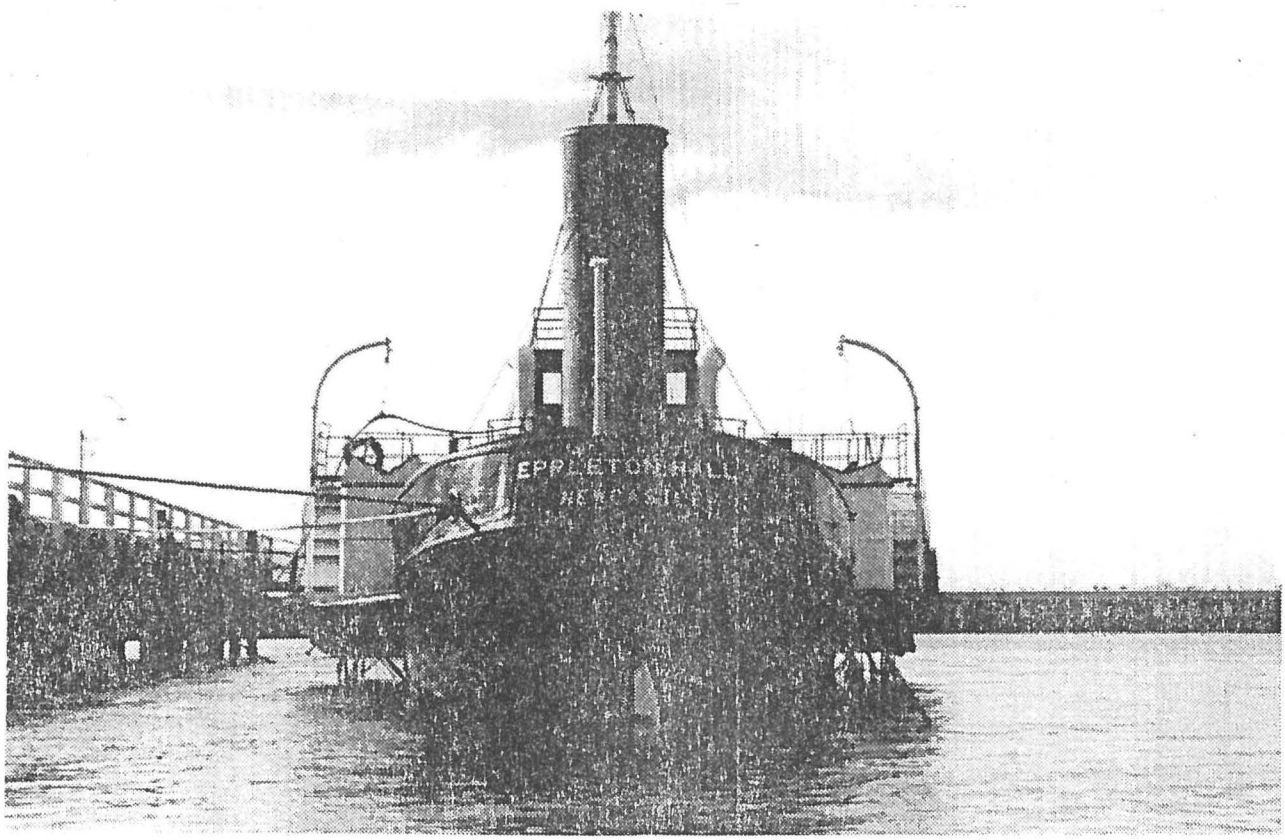


Fig. 12. EPPLETON HALL at her moorings off Hyde Street Pier, as viewed from astern. She remains, unmistakably, a Tyne paddle tug.

2-4. Measured Scale Drawings

2-4.1. Existing Condition Drawings

Index

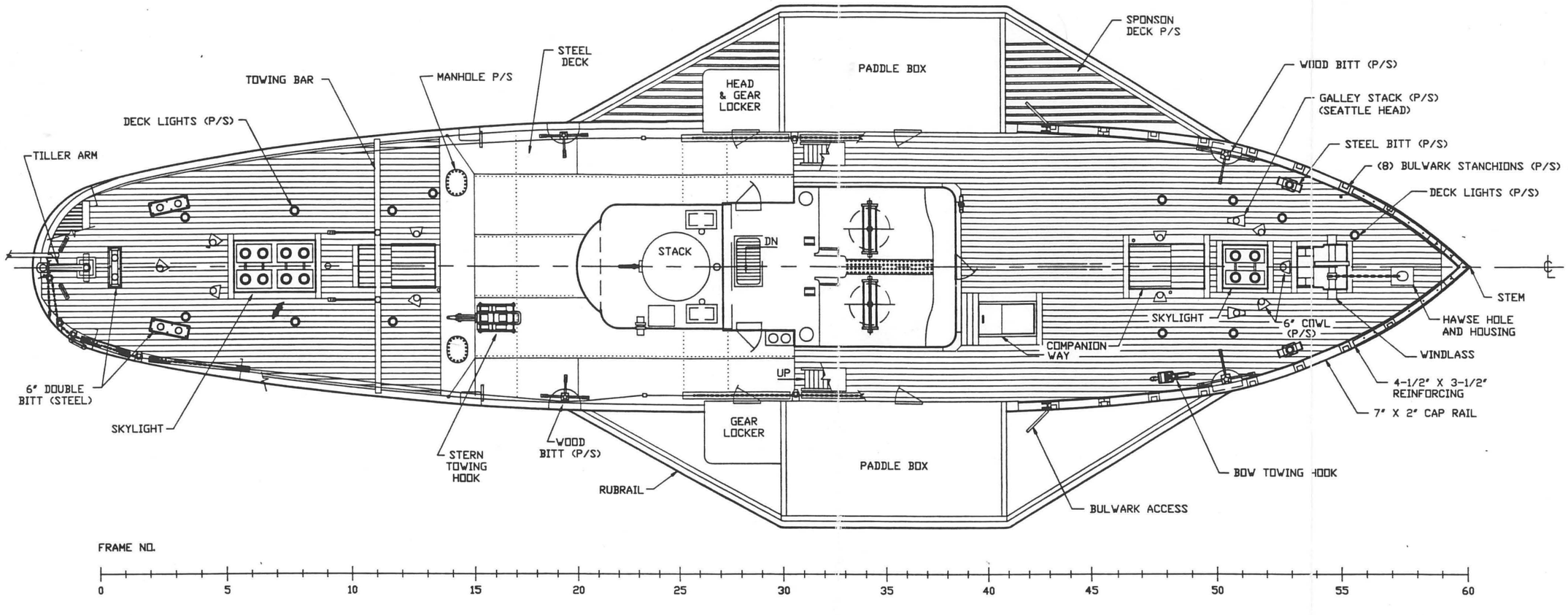
Sheet 1: Main Deck Plan and Hold Plan
Sheet 2: Bridge Deck
Sheet 3: Electrical Arrangement
Sheet 4: Fire, Bilge, and Feed Water Piping

Explanation of Drawings

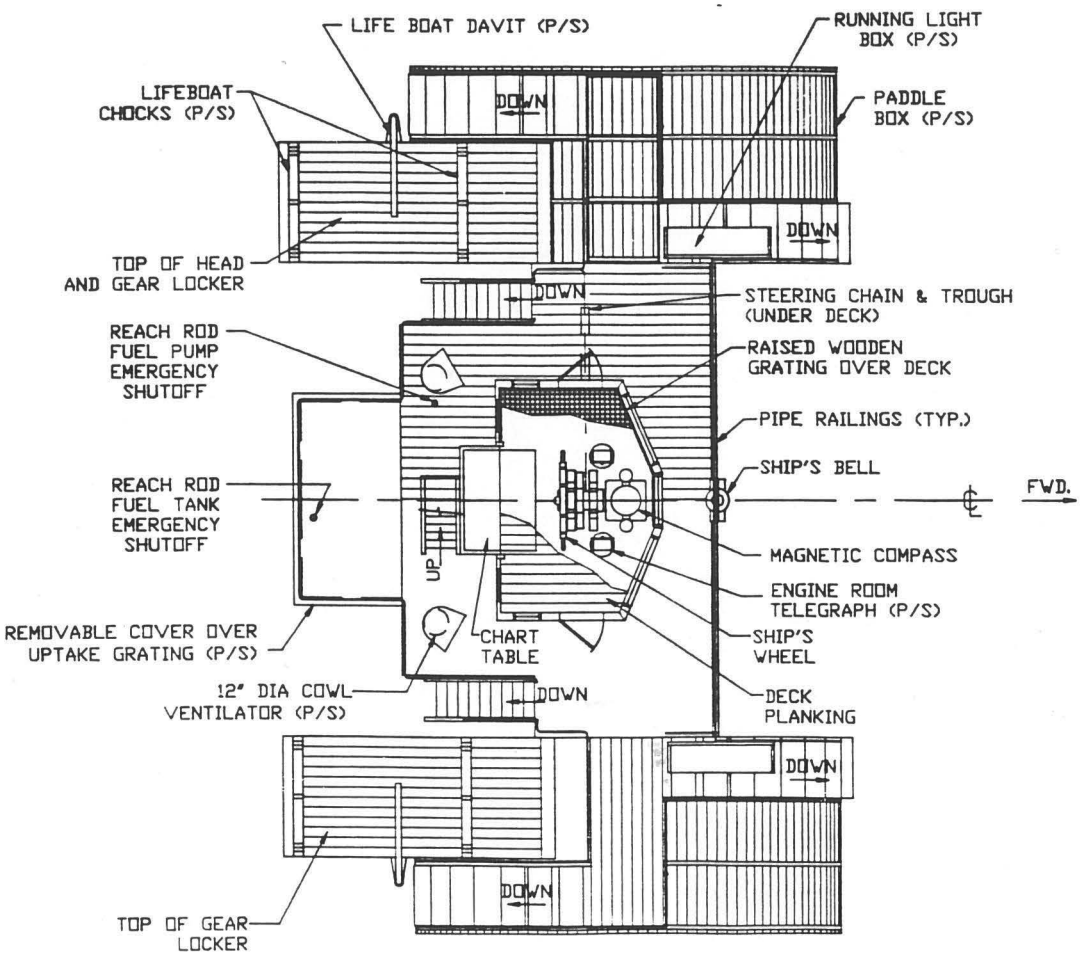
The existing condition drawings produced for this report are limited to general arrangement drawings and systems diagrams. Due to funding limitations, a full set of documentation drawings was not possible. Priority was given to production of those drawings felt to be most useful in the maintenance of the vessel.

The drawings were produced using Autocad, a computer-aided design program (CAD) written for use on IBM-compatible personal computers. Each drawing was mechanically plotted using four pen sizes to achieve varying line weights. The drawings were plotted at 1/4" scale and reduced by fifty percent for inclusion in the report.

The decision to use CAD was based on practical considerations as well as cost. CAD drawings are more versatile than those produced by hand; they can be printed at any scale and are stored on a medium ideal for conservation and reproduction. In addition, important historical and maintenance data can be assigned to specific elements of the drawing and stored in a data base attached to the drawing's computer file. For these reasons, the use of CAD is recommended for further documentation of the vessel.



CONTRACTOR: TRI-COASTAL/ DE PAVLOFF CO.	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
DRAWN: C.R./M.B.		PADDLE TUG "EPPLETON HALL"	350
TECH. REVIEW: D.BIRKHOLZ JR.		**MAIN DECK PLAN AND HOLD PLAN**	60003
DATE: 10/90		SAN FRANCISCO MARITIME NATIONAL HISTORICAL PARK	SHEET NO. 1 OF 4



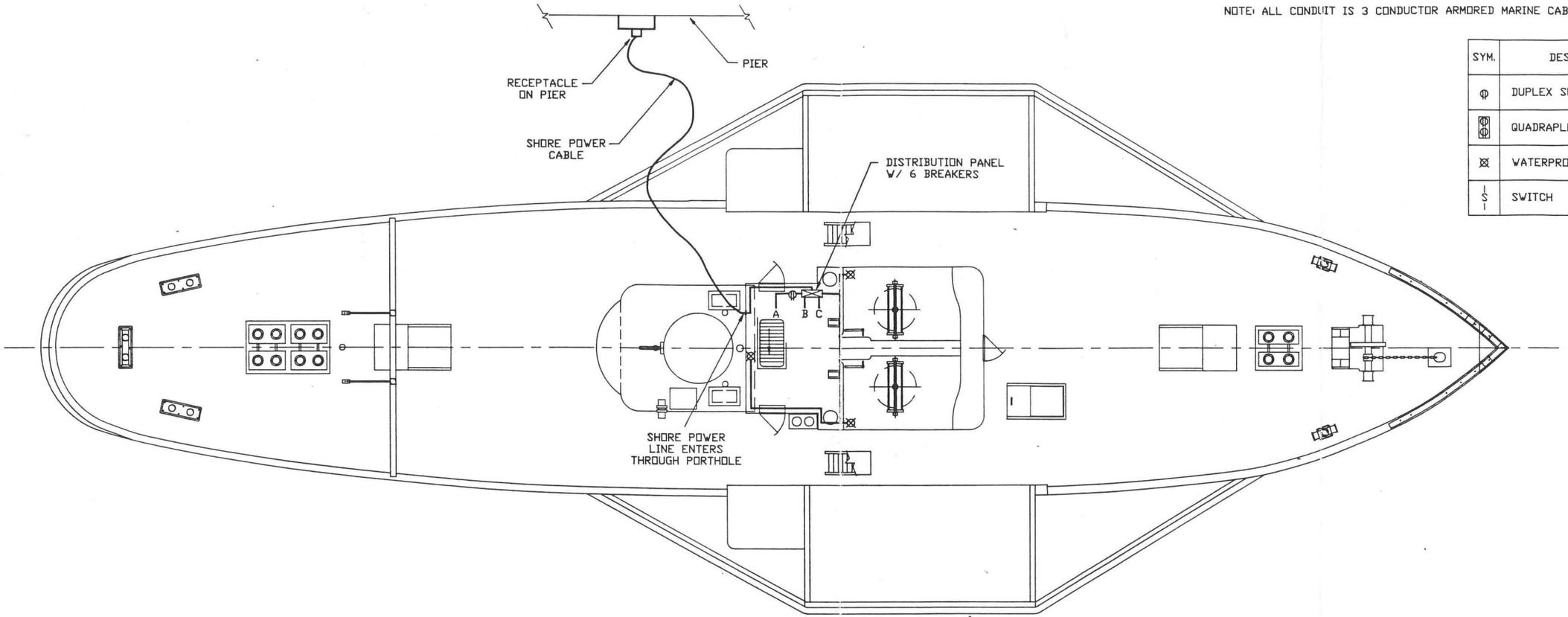
20 15 10 5 0

SCALE IN FEET

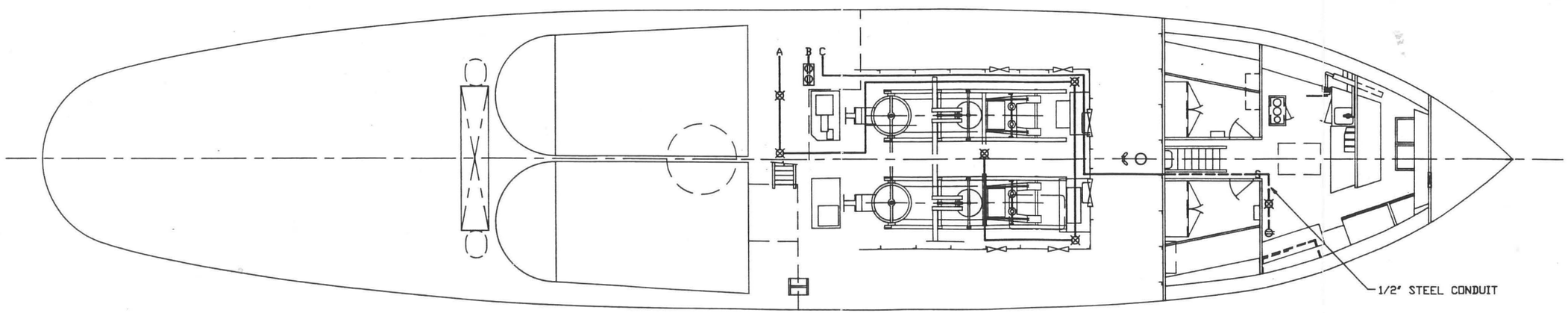
CONTRACTOR: TRI-COASTAL/ DE PAVLOFF CO.	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
DRAWN: C.R./M.B.		PADDLE TUG "EPPLETON HALL"	350 60003
TECH. REVIEW: D. BIRKHOLZ JR.		**BRIDGE DECK**	SHEET NO. 2
DATE: 10/90		SAN FRANCISCO MARITIME NATIONAL HISTORICAL PARK	OF 4

NOTE: ALL CONDUIT IS 3 CONDUCTOR ARMORED MARINE CABLE EXCEPT AS NOTED.

SYM.	DESCRIPTION
⊕	DUPLEX SERVICE OUTLET
⊕⊕	QUADRAPLEX SERVICE OUTLET
⊠	WATERPROOF LIGHT
|S|	SWITCH

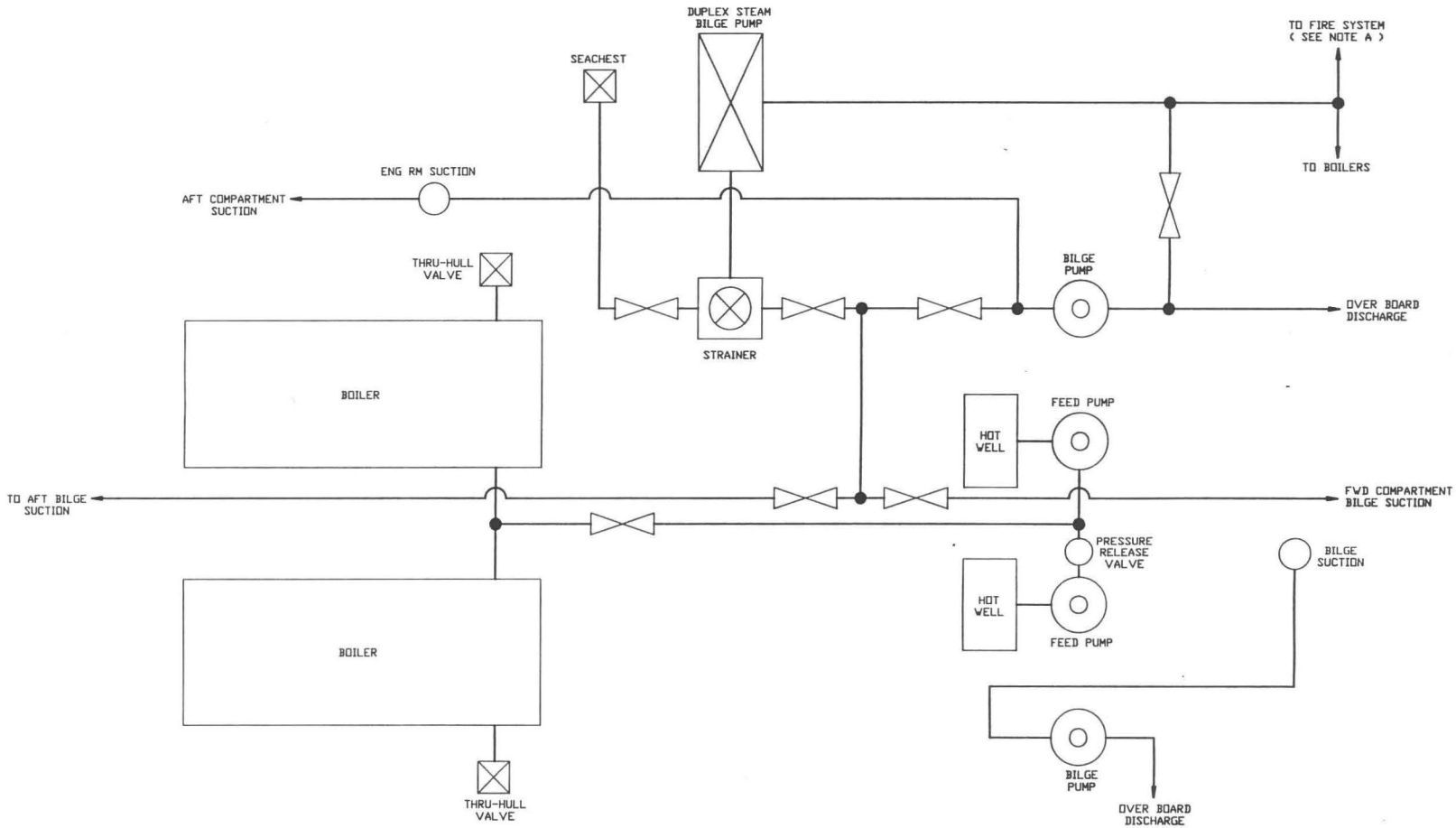


MAIN DECK



HOLD PLAN

CONTRACTOR: TRI-COASTAL/ DE PAVLOFF CO.	SUB SHEET NO.	TITLE OF SHEET: PADDLE TUG "EPPLETON HALL"	DRAWING NO. 350 60003
DRAWN: C. ROSS		**ELECTRICAL ARRANGEMENT**	SHEET NO. 3 OF 4
TECH. REVIEW: D. BIRKHOLZ JR.		SAN FRANCISCO MARITIME NATIONAL HISTORICAL PARK	
DATE: 10/90			



NOTE A: FIRE STATIONS - (1) FWD. OF FIDDLEY
(2) AFT OF FIDDLEY

CONTRACTOR: TRI-COASTAL/ DE PAVLOFF CO. DRAWN: C. ROSS TECH. REVIEW: D. BIRKHOLZ JR. DATE: 10/90	SUB SHEET NO.	TITLE OF SHEET PADDLE TUG "EPPLETON HALL" **FIRE, BILGE, AND FEEDWATER SYSTEM** SAN FRANCISCO MARITIME NATIONAL HISTORICAL PARK	DRAWING NO. 350 / 60003 SHEET NO. 4 OF 4

2-4.2. Historical Drawings

The following historical drawings are from the plan archives of the San Francisco Maritime NHP's Documents Department. They constitute the only known historical drawings of the vessel. The drawings are reproduced here in reduced form and are therefore not to scale.

Explanation of Historical Drawings

Figure 13: General Arrangement (SFMNHP Record #1758)

This drawing was produced by EPPLETON HALL's builders, Hepple and Company for construction of the vessel (ca. 1914) and shows an inboard profile, hold plan, and deck plan. Historic photographs and existing physical evidence indicate that the paddle tug was built faithfully to these plans. The original arrangement of the accommodations spaces is clearly evident in the inboard profile and hold plan, while the original deck layout, complete with deck furniture and fittings, is documented in the deck plan.

Figure 14: Midship Section (SFMNHP Record #1760)

The midship section drawing was also produced for construction of the vessel. This drawing defined the basic structure of the hull. Of particular interest are the notations which indicate the dimensions and type of material used for decks, rails, and other wood structures that have long since been removed or altered. The survey of existing condition indicates that the steel hull structure has undergone little change since construction.

Figure 15: Tug Boat Boiler (SFMNHP Record #1761)

This drawing is one of two produced for construction of EPPLETON HALL's replacement boilers built by Riley Boilers Limited and installed in 1946. These drawings provide excellent documentation of the existing boilers.

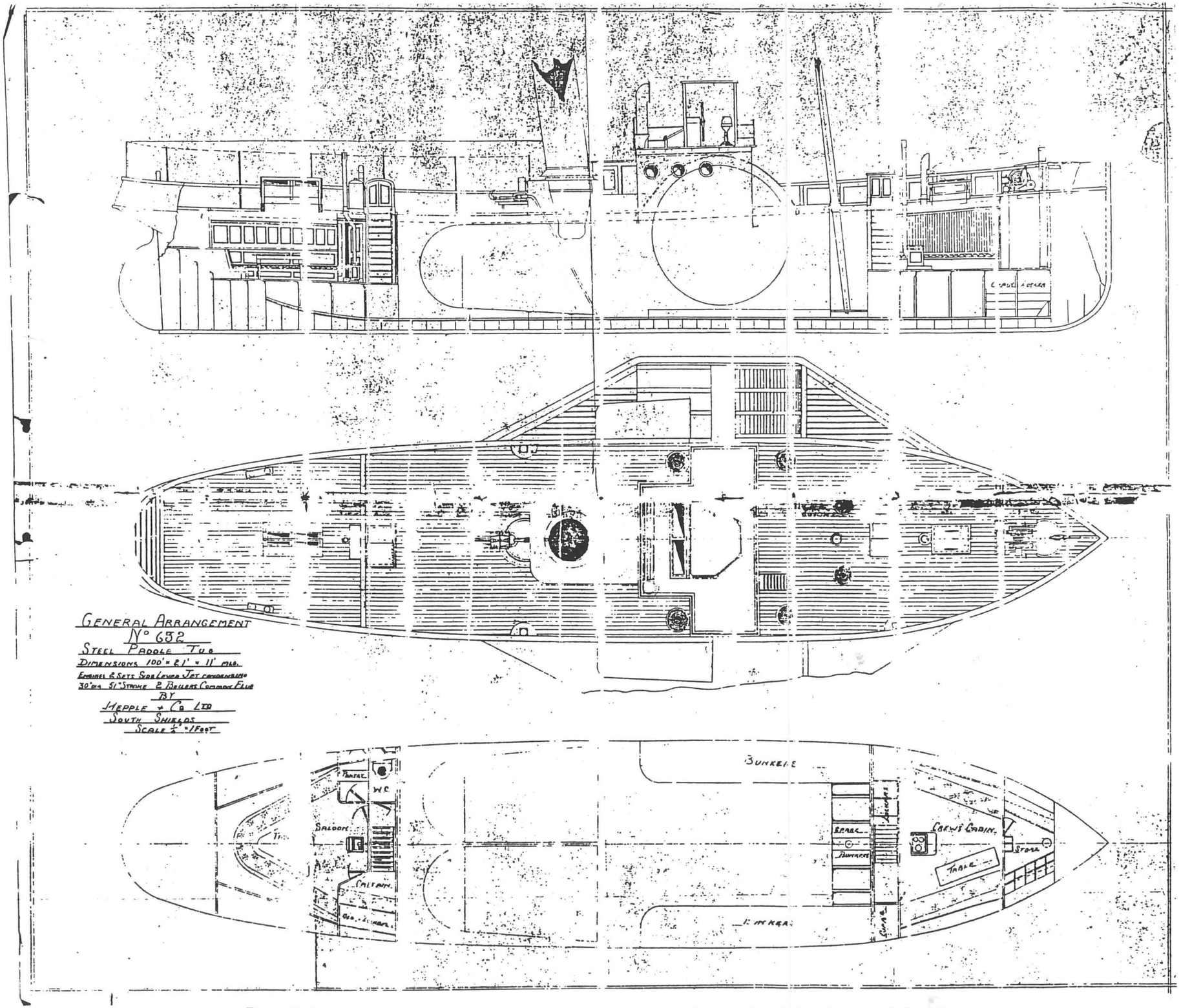


Figure 13. General Arrangement of EPPLETON HALL: Inboard Profile, Hold Plan, and Deck Plan. SFMNHP Coll. #555, Rec. #1758

Midship Section
Steel Paddle Tug
N°652
Dimensions 100'x21'x11'mld
Scale ½" = 1 Foot

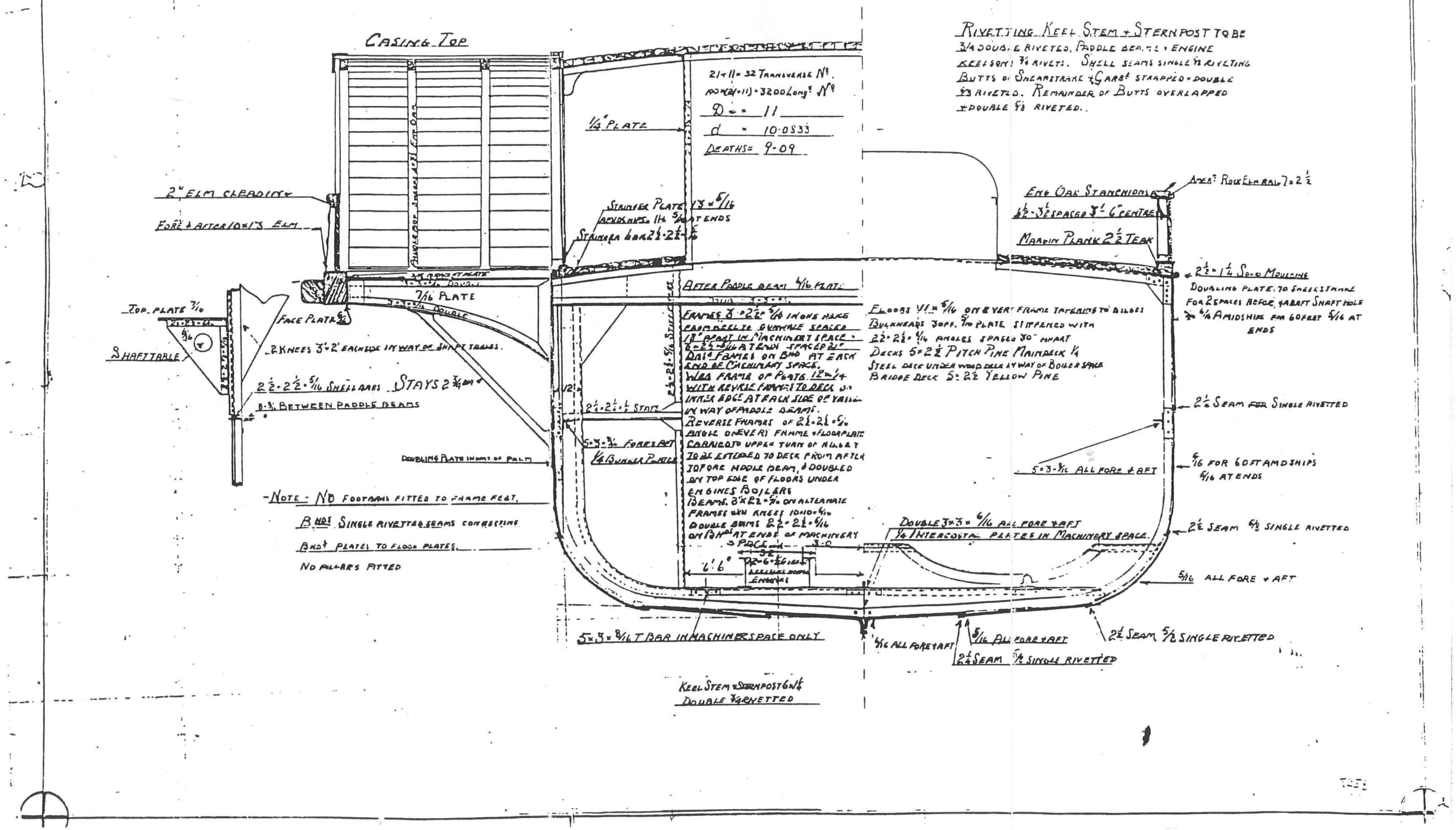


Figure 14. Midship Section, EPPLETON HALL. SFMNHP Coll. #555, Rec. #1750

SPECIFICATION OF MATERIALS

SHELL PLATES & MAIN STAYS 28-32 TONS

BALANCE OF PLATES RIVETS SCREW STAYS ETC 26-30

SHELL RIVETING

DETAIL OF MAIN STAY SUPPORTS

FRONT ELEVATION

SECTIONAL ELEVATION

VIEW ON AA

SECTIONAL PLAN

NOTE: PORT BOILER AS DRAWN
STBD BOILER OPPOSITE HAND

DETAIL OF DOUBLE EYE STAY ENDS & RODS OTHER END SINGLE EYE

DETAIL OF SINGLE EYE STAY ENDS (22 ENDS REQD)

NOTE: ALL STAY ENDS ARE TO BE FORGED OUT OF SOLID STAY & ANNEALED

DETAIL OF FLUE WELDING

DETAIL OF UPTAKE WELDING

NOTE: AFTER FLUES ARE ROLLED & WELDED THEY ARE TO BE ANNEALED IN A TEMP OF 1100°F FOR A PERIOD OF 28 MINS & SOAKED FOR 32 MINS & ALLOWED TO COOL IN STILL AIR

HEATING SURFACE 400 SQ FT.
GRATE AREA (SOBM) 26·4

STOCKTON CHEMICAL ENGINEERS & RILEY BOILERS LIMITED
1 STOCKTON-ON-TEES

AMENDMENTS			
LETTR	DESCRIPTION	DATE	Drawn By
A			Traced By
B			
C			
D	FLUE STAYS ALTERED		

9-9 × 9-3 × 8-6 × 18-0 L.G. TUG BOAT BOILER.

No. 836 A B C D.

6876-7. SCALE 1" = 1 FT. W.P. 35 LBS. TEST PRESS. 70 LBS. B.O.T.

Figure 15. Boiler Details: construction plans for replacement boilers installed in EPPLETON HALL in 1944. SFMNHP Coll. #555. Rec. #1761

2-5. Analysis of Treatment Options

2-5.1. Summary of Planning to Date

EPPLETON HALL has received little attention since her acquisition by the National Maritime Museum in 1979. The paddle tug that steamed on the Bay amid fanfare in the 1970s now lies dormant at her moorings, inoperable, inaccessible to the public, and only occasionally visited by maintenance staff. As a result, she is rotting and rusting away. A primary reason for this neglect is the fact that she has been perceived by Park management as having little historical relevance to the general theme of the Maritime Park, and has therefore been considered a low priority relative to the rest of the fleet. A lack of historical context was cited as the reason for rejecting her nomination to the National Register of Historic Places (National Register 1979).

In 1987, the Interpretive Prospectus for the Maritime Museum referred to the paddle tug as the Museum's "stepchild", but nevertheless recommended she be opened to the public and interpreted (NPS 1987). The following year, the Cultural Resources Management Plan for the Fleet ("Fleet Plan"), stated:

> "Recommending a course of action for EPPLETON HALL's long-term preservation is problematic. The value of the ship to the collection depends on whether the [Museum's] curatorial policy is firmly bound to seeking local homogeneity, or can accept a larger and more eclectic view of ships as artifacts. Even if the decision is reached that the ship is not sufficiently relevant to the rest of the fleet, there is still a responsibility to recognize her historic significance as the last example of a technologically important type" (Tri-Coastal Marine 1988).

The Fleet Plan went on to recommend immediate stabilization, and beyond that, outlined a plan for complete restoration. To date, no specific action has been taken, other than sporadic maintenance efforts, most of which have been directed at improving the vessel's appearance. EPPLETON HALL has continued to be a low priority in the allocation of the limited funding for preservation of the ships. The following treatment options are assessed in light of EPPLETON HALL's present status, and with consideration for the Maritime Park's commitment to the historic fleet as a whole.

2-5.2. Disposal

EPPLETON HALL's significance as the last intact example of a Tyne paddle tug should rule out disposal as an acceptable option. The only reasonable excuse for scrapping the vessel would be that it was necessary in order to save historically significant fabric such as the engines and boilers. This is not the case at present, as these items can be preserved in situ by stabilizing the vessel as a whole.

2-5.3. Deaccession

Deaccessioning EPPLETON HALL from the collection would be justified in the case that, 1) the Maritime Park lacked the resources to properly preserve the vessel, or 2) the vessel was determined to be out of context with the theme of the Park, and therefore not deserving of preservation funding.

From a moral standpoint, giving the vessel to an organization that was willing and able to properly preserve her would be preferable to continuing the present course of wholesale neglect. This option would also be preferable to a limited treatment, such as stabilization, that would leave her unrestored and inaccessible to the public over the long term.

The question of the relevance of EPPLETON HALL to the overall theme of the Maritime Park is one which has been addressed in other reports, but never resolved. The purpose of the Park, as stated in the enabling legislation forming the new SFMNHP in 1988 (H.R. 1044), is "to preserve and interpret the history and achievements of seafaring Americans and of the nation's maritime heritage, especially on the Pacific Coast ..."

Unlike the other vessels of the historic fleet, all of which have a direct historic relationship to this theme, EPPLETON HALL's relationship is tenuous at best. While she is, without question, a historically significant vessel, she has no direct historical connection to the Pacific Coast or to American seafaring (with exception of the dramatic post-historic voyage that brought her to this country), nor is she representative of an American type. There were paddle tugs on San Francisco Bay, but they were not common and would have borne only a superficial resemblance to EPPLETON HALL.

Many of EPPLETON HALL's most characteristic features (twin side-lever engines, salt water boilers, feathering paddlewheels) are British developments found almost exclusively in tugs from the Tyne river area of England. While these tugs were exported to other areas of England and to other countries (Kortum 1970), there is no evidence that any had ever steamed on the West Coast until EPPLETON HALL's arrival in 1970.

In a broader sense, EPPLETON HALL can be said to represent the ancestry of all tug boats. She could be integrated into the fleet under this theme if the scope of the Maritime Park is expanded to encompass a more global interpretation of maritime history.

Deaccession would require more than a simple decision -- a capable and interested organization will have to be identified. If the transfer of ownership is to have a positive effect, the receiving organization would need to have sufficient resources and expertise to carry out an appropriate treatment, and to successfully maintain the vessel thereafter.

The most historically appropriate location for EPPLETON HALL would be England, ideally a port on the rivers Tyne or Wear. Yet surprisingly, she was awaiting scrapping when discovered by Scott Newhall on the River Tyne in 1969. At that time, there seemed to be little awareness of the vessel's significance in her country of origin (In fact, Newhall's effort to acquire a paddle tug was prompted by the knowledge that the last steam paddle tug operating in England, RELIANT, was going to be dismantled for display in the National Maritime Museum at Greenwich).

While there is evidence that England has become more aware of her maritime heritage in the ensuing twenty years, finding an organization that is capable, as well as willing, to care for EPPLETON HALL may be difficult -- as in the United States, efforts at maritime preservation are marked by funding shortages. Nevertheless, further investigation of this option is recommended if an appropriate treatment is deemed beyond the means or scope of the Maritime Park.

2-5.4. Stabilization

Stabilization would involve measures to arrest ongoing deterioration that is damaging historic fabric or threatening the safety of the vessel. This would include steps such as erecting protective covers over leaking decks, sealing off hull openings, installing automatic bilge pumps and a cathodic protection system, and application of protective coatings.

This option is not an end in itself, but an interim treatment intended to preserve the vessel essentially "as is" until a long-term treatment can be undertaken. If the vessel is successfully stabilized, the decision on which course of action to take for long-term treatment can be deferred for a limited period without impacting the vessel (other than the visual impact of the stabilization measures themselves, all of which should be reversible).

Stabilization has practical limits and should be considered for the short term only. An effort to maintain the vessel in a stable condition for a long period, say five years or more, without doing proper preservation or restoration work, will consume Park funds and crew time, yet will not improve historic integrity or benefit interpretation.

Even if the decision is made to pursue another option, such as restoration or deaccession, immediate stabilization measures will be needed to slow EPPLETON HALL's rate of deterioration until a plan can be implemented.

2-5.5. Restoration for Static Exhibit Afloat

Restoration of EPPLETON HALL as a permanently moored floating exhibit would involve preservation of existing historic fabric,

restoration of historic items that have been damaged or have undergone nonhistoric alteration, and replication of significant features that are now missing. Arrangements would be made for public access at the Hyde Street Pier, possibly including modifications to the vessel in order to allow access to compartments below decks.

A proper restoration will be an undertaking far in excess of the 1969 rebuild. For one thing, the boilers and hull were in much better condition at that time. In addition, the hull as found was essentially gutted. Today, a considerable amount of work will be required to remove nonhistoric fabric just to get at the significant fabric for treatment. Furthermore, several historic features removed or altered during the 1969 rebuild will now have to be restored or replicated in order to return EPPLETON HALL to her appearance during the historic period of 1914-67 (The decision on which target period to choose for restoration will have only a minimal affect on the scope of work, as few major changes were made during her working years).

A full restoration will have to address almost every item on the vessel, most of which require major work. The engines will have to be completely overhauled in order to effectively preserve them. The boilers will require preservation, both inside and out, to stop massive and ongoing deterioration. Preservation of the hull will necessitate removal of the nonhistoric fuel tanks and piping, as well as all of the woodwork in the accommodations.

Some level of operation would be possible, but would probably be limited to rotating the engines and machinery for display purposes, as is done with EUREKA's walking-beam engine. Indeed, periodic rotation of the engines will be essential for maintaining the paddle wheels, which will remain partially immersed in sea water.

As a floating exhibit, EPPLETON HALL would be maintained in her historic setting (not to be confused with historic location, which would be the rivers Tyne or Wear in England). Preservation in the marine environment would demand consistent maintenance, but the maintenance load could be reduced considerably if modern technology, in the form of wood preservatives, anti-corrosive coatings, and cathodic protection systems, is employed in the restoration.

2-5.6. Restoration for Exhibit Ashore

Restoration for exhibit ashore would have roughly the same scope of work as restoration for exhibit afloat, but the vessel would be placed in a dry berth at a suitable site. The initial cost for this option would probably be higher due to the additional expense of site development. Finding a "suitable site" in the vicinity of the Maritime Park would likely be difficult and EPPLETON HALL would probably have to be separated from the rest of the fleet.

Dryberthing would not result in a major reduction in long-term maintenance costs. With the exception of the periodic drydocking needed for bottom maintenance, all maintenance requirements would be much the same as for a floating vessel. Maintenance costs would be greatly reduced if EPPLETON HALL were to be placed inside a protective structure. At a minimum, a building approximately 120' x 50' x 45', or 6,000 square feet, would be required to house the vessel. Such a structure would add considerably to initial site development costs. Perhaps the strongest argument against dryberthing is that it would remove EPPLETON HALL from her historic setting.

2-5.7. Restoration to Operating Condition

In addition to the work required to restore the vessel for static display, a return to operating condition would require full restoration of the boilers, machinery, and equipment. Depending on the intended level of usage, further work would be necessary to ensure safe operation. Since the engines and paddlewheels would be restored under the static exhibit option, the major additional work under this option would be the restoration of the boilers.

The boilers were condemned in the early 1980s (Hartford Steam Boiler 1983), due primarily to wastage of the fire boxes and shells. Both boilers have undoubtedly suffered additional wastage since that time, and it is unlikely they can be made safe for operation with only minor repairs, as they were in 1969. The boilers would therefore need major work, for which they would have to be removed from the vessel. In addition to renewal of boiler shell plating, furnaces, and stays, the steel deck over the boilers would have to be cut away to get them out of the vessel. Despite the relative simplicity of their design, the boilers are constructed of complex riveted forgings that would be very difficult and costly to reproduce with any degree of historic accuracy.

Even with the boilers completely restored, their archaic design will make them somewhat risky to operate, requiring constant attendance by skilled operators, of which there are very few today.

Former operators of the vessel have suggested replacing the historic boilers with one or more modern boilers that are safe and efficient. While this approach would solve the safety problem, and might be less costly than restoration of the existing boilers, it would seriously impact historic integrity by removing one of the vessel's most significant features.

Restoration to operating condition would have many benefits, including increased support from volunteers and the general public that could substantially aid her preservation, but is not recommended unless it can be achieved without compromising safety and historic integrity.

2-5.8. Conclusions

EPPLETON HALL's significance warrants a comprehensive treatment that will restore historic integrity and allow full interpretation, including public access. Restoration for floating exhibit appears to offer the best means of achieving this while maintaining integrity of setting. If the Maritime Park cannot justify this level of treatment due to funding limitations or thematic constraints, deaccession to a worthy organization should be considered. In any case, stabilization measures should be implemented immediately in order to prevent further loss of historic fabric.

2-6. Proposed Treatment

2-6.1. Overview

The proposed treatment for EPPLETON HALL is restoration for use as a permanently moored exhibit. The primary goals of this treatment would be: 1) to preserve historically significant fabric, 2) to restore the vessel to accurately reflect her historic usage, and 3) to provide comprehensive interpretation through public access to important areas of the vessel, such as engine room and crew accommodations.

The proposed treatment would not attempt to restore EPPLETON HALL to full operating condition, as recommended in the Fleet Plan (Tri-Coastal Marine 1988). This departure is based primarily on safety concerns. The only major change in the scope of work of the previous plan is in the treatment of the boilers, which would be preserved rather than restored. The proposed treatment would not preclude the possibility of steaming the vessel at some future date, if safety problems can be worked out.

The immediate goal will be to stabilize the vessel's condition. Restoration should be initiated within a reasonable length of time, preferably in two to three years. To indefinitely delay implementation of a long-term treatment plan will result in an inefficient use of Park resources as materials and staff time are expended in an effort to maintain a partially deteriorated vessel that remains inaccessible to the public. It is recommended that a definite cutoff date be established for a decision to either proceed with restoration of EPPLETON HALL or deaccession her to an organization that is willing and able to do so.

2-6-2. Interim Treatment: Stabilization

Listed below are recommended steps for arresting or slowing deterioration of the vessel until long-term treatment can be undertaken. Additional recommendations for maintenance are given in the Survey Findings in Section 3 of this report. All of these steps can be carried out with the vessel in the water at her present location. Stabilization measures will have only limited effectiveness and cannot be counted on to solve long-term preservation problems. As temporary measures, they should be carried out in a manner that will not permanently mar or alter significant fabric. Some measures will have a visual impact, but this is considered justified for the short term in the interest of preserving the vessel.

Provide Weather Protection

Bilge water and attendant high humidity is the primary cause of corrosion of the hull interior and machinery. Most of bilge water is believed to come from rain that is leaking in through a

variety of sources. The presence of hull leaks cannot be determined until all rain water leakage is stopped. Known sources of leakage include deck seams, wasted scuppers, and rust holes in ventilators and stack. Attempts have been made to seal some of these areas, with varying degrees of success. The vessel should be monitored for signs of leakage during periods of rain, and steps taken as needed. Surfaces that cannot be effectively sealed should be covered with awnings or tarps.

In addition to preventing leakage into the vessel, steps should be taken to protect exposed exterior surfaces that are corroding or rotting. These include topsides, bulwarks, paddle wheels and paddle boxes, fidley and deckhouses, steel deck plates, deck furniture, ventilators, stack, mast, rudder bearing, and any other items that show active corrosion or decay. To expedite the work, stabilization measures should be kept simple.

- Rusting surfaces: scale by hand, treat with a chemical rust stabilizer (Ospho, Corroseal) and coat with conventional anti-corrosive paint. Exterior metal surfaces should be periodically rinsed with fresh water to remove corrosive salt buildup.

- Wood surfaces: coat with wood preservatives. Use products that are safe and easy to apply, such as sodium borate or copper napthenate.

Protect the Underwater Hull

EPPLETON HALL has not been drydocked for bottom maintenance since 1983. Regardless of the quality of bottom coatings applied at that time, the underwater hull is overdue for maintenance and is probably corroding at a rapid rate. The best way to deal with this problem is to drydock the vessel and sandblast and coat the bottom. Short of this, corrosion can be slowed by installing cathodic protection. As an immediate step, sacrificial zinc anodes should be suspended from the topsides on wires that are electrically bonded to the hull (this has already been done in a limited way). Four anodes, of 20-40 pounds each, suspended at even intervals along each side should be sufficient. Additional anodes should be suspended from the paddle wheel ironwork.

Better protection would be provided by an impressed current system, which EPPLETON HALL should have in any case for long-term preservation. Such a system should be installed as soon as possible. The following specifications are recommended:

Six platinum anodes (three per side)
Automatic current control with two reference cells
Bonding of rudder and all immersed paddlewheel ironwork

Reduce Interior Moisture Level

In addition to stopping rain water leakage, the following steps

should be taken to reduce interior moisture levels:

- Install automatic bilge pumps in the forward compartment, engine room, and aft compartment. Pumps should be positioned to keep bilge water levels at an absolute minimum.

- Install marine-grade light fixtures in all compartments. Locate lights for maximum effect in dispelling moisture, with a minimum of three in the forward compartment, six in the engine room, and three in the aft compartment. Use bulbs of at least 75 watts and keep them burning at all times.

Arrest Corrosion on Machinery, Boilers, and Hull Interior

Even with interior moisture levels reduced, corrosion will continue on unprotected surfaces of machinery, boilers, and hull interior. Long-term preservation will involve careful surface preparation and application of durable coatings. This will be a major undertaking that will probably not begin until a decision is made to proceed with restoration. In the interim, protective coatings can be applied that do not require labor-intensive surface preparation. Their effectiveness will be temporary only and the process will have to be repeated if more permanent measures are not taken within 18 to 24 months, depending on the moisture level in the hull interior.

Boilers: Rinse with fresh water to remove salt deposits. Apply rust stabilizing chemicals inside and out.

Engines: Coat all unpainted surfaces with grease or heavy oil.

Hull: Coat with Eureka Fluid Film Gel B or equivalent anti-corrosive soft film coating. On interior surfaces that are presently painted, treat areas of corrosion with rust stabilizer and recoat with conventional paint.

Install Fire and Bilge Alarms

A fire and bilge warning system should be installed with alarms located at manned stations on the pier (this is a permanent recommendation that applies to all vessels in the historic fleet). Smoke detectors and bilge water level sensors should be located in each compartment.

Provide Pier-side Access

One of the major impediments to routine maintenance has been the lack of a convenient means of access to the vessel. To get aboard, one must row out in a small boat and ascend a jacob's ladder, thus making it difficult to transfer materials and equipment. There is no reason why a simple brow could not be installed to provide access directly from the pier. Alternately,

the EPPLETON HALL could be turned around and a gangway run from her stern to the barge moored at the end of the pier. Either way, direct access should be provided during the stabilization phase.

2-6.3. Long-term Treatment: Restoration

The following recommendations address each element of EPPLETON HALL individually. Together, the recommendations constitute a basic plan for achieving the proposed treatment: restoration as a floating exhibit. A suggested sequence for carrying out the restoration is given in section 2-7.

Repair/Preserve Hull

The recommendation for the hull is to preserve as much of the original shell and internal structure as possible, and to make repairs only as needed to keep the hull watertight. Measurements of hull thickness taken during survey (see section 3.1.28.) indicate that much of the shell retains adequate thickness to maintain watertight integrity, but that there is very little margin for further wastage. For this reason, a state-of-the-art coating system should be used on both interior and exterior surfaces, and an impressed current cathodic protection system installed to keep further corrosion to a minimum.

Where repairs are required, all efforts should be made to preserve the hull's original riveted construction. Riveting of hull plating, particularly below the waterline, will be cost prohibitive, thus necessitating the use of welded inserts or doubler plates. Hull repairs should be carried out in manner that will minimize visual impact and reduce welding stresses.

To prevent the ongoing corrosion that results from weeping rivets and seams below the waterline (a condition that may actually be exacerbated by welded hull repairs), epoxy filler should be used, as was done in BALCLUTHA's hull preservation during her 1986 drydocking (NPS 1985).

Recommended steps for hull preservation are as follows:

1) Hull Interior: Sandblast hull and bulkheads in forward and after compartments (after removal of all interior woodwork), waterblast hull and bulkheads in engine room. Apply a high-build epoxy coating throughout.
2) Hull Exterior: Sandblast entire hull exterior. Apply high-build epoxy coating. Do not ring-weld leaking rivets. Seal all rivets and seams below the waterline with epoxy filler. Except where absolutely necessary, use welded plate doublers rather than inserts.

Renew Wood Decks

The wood decks and many of the supporting steel deck beams were installed in 1969 and are not historic fabric. Unfortunately, the work done at that time was not adequate for long-term preservation. The steel deck structure has rusted beneath the wood planks and the expanding rust scale has lifted the planking, thus leading to further leakage and corrosion. Although the wood decking is not extensively rotten, all planking will have to be removed in order to preserve the steel deck beams and stringer plates beneath. Renewal of approximately 2,200 linear feet of deck planking will be required. To restore the decks to the original builder's specification, planking would be 5" x 2-1/2" yellow pine (Douglas fir could be substituted) and margin planks would be of teak. The amount of repairs, if any, the deck steel structure will need cannot be determined until the deck planks are removed. It is likely that the deck beams over the coal bunkers will have to be temporarily removed in order to scrap the nonhistoric fuel tanks.

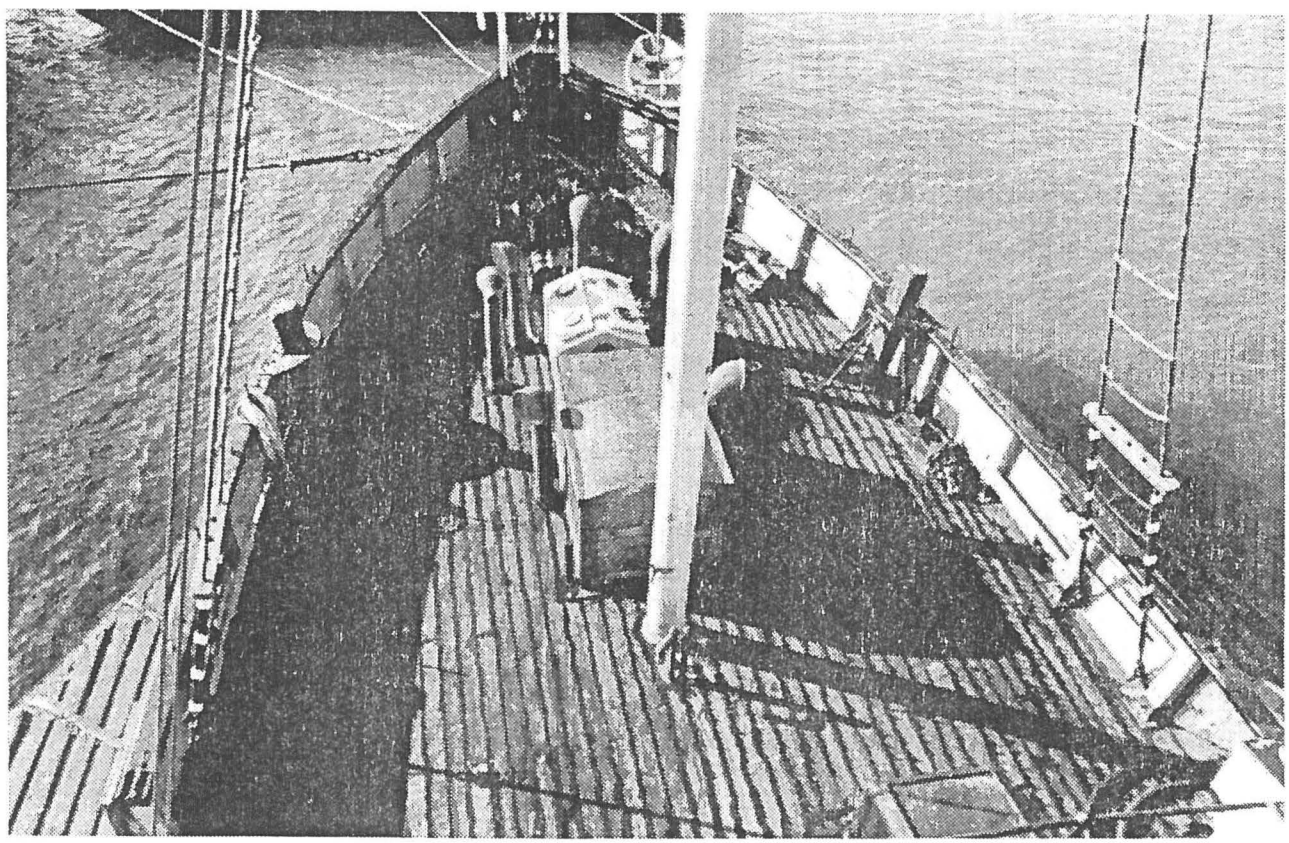


Fig. 16. EPPLETON HALL's foredeck, as seen from the bridge deck. Planking appears sound, but hides active corrosion on steel structure beneath.

Preserve Boilers, Restore Fire Boxes

Under the proposed treatment, the boilers would be preserved as they are, with no major repairs. Restoring them to operating condition is not recommended at this time due to the extent of deterioration they have suffered and the risks inherent in operating this type of boiler. Nevertheless, the boilers should not be altered in any way that would preclude a possible future restoration.

Preservation will involve cleaning and coating the interior and exterior surfaces of the boilers and uptakes. Water blasting and coating with anti-corrosive paint will provide lasting protection (sandblasting is not recommended within the engine room). Where limited accessibility makes water blasting difficult, a spray-on rust stabilizer can be used for surface preparation. Another preservation problem will be chloride contamination. The boilers have likely become contaminated with salts after years of holding heated sea water. Unless the chloride is neutralized, corrosion may continue despite protective coatings. Although the water blast should help to remove some contaminates, the chloride will probably have to be chemically neutralized.

To return the boilers to their original coal-burning configuration, the oil burners should be removed and the coal fire boxes restored. There is no evidence remaining of the fire boxes; research will be required to accurately replicate them.

For additional protection against corrosion, electric lights should be installed inside the boilers. The lights will help dispel moisture and could also afford the public a better view of the interior workings of the boilers.

Restore Engines

The best means of preserving the engines will be to restore them to fully operational condition, but not necessarily to run them on steam. Due to the difficulty of controlling the humidity level in the engine room, the engines will need to be turned over periodically, either by compressed air or electric jacking gear, in order to keep them from freezing up. Regular rotation of the engines will also be essential for maintaining the paddle wheels, and would have interpretive value.

Both of the engines will need to be disassembled and inspected internally in order to determine the extent of necessary work. Restoration should include all engine driven auxiliaries: two condensate pumps, two boiler feed pumps, and two bilge pumps. While disassembled, the engines and all associated equipment should be fully documented through measured scale drawings and photographs.

Restore Engine Room, Coal Bunkers

Even if public access is not allowed to the lower level of the engine room, this compartment should be stripped of all nonhistoric items and restored to its appearance during the historic period. Work will include removal of the diesel auxiliaries, fuel piping, and fuel tanks. The coal bunker bulkheads that were cut away in 1969 (in order to stuff fuel tanks into the bunkers) should be restored, as should the six coal scuttles originally located on the deck above the bunkers. Both the upper and lower engine room levels should be dressed out with appropriate historic appointments (coal shovels, oiling cans, etc.).

Replicate Original Accommodation Spaces

The fore and aft accommodations spaces should reflect the historic use of the vessel. Unfortunately, the existing interior woodwork installed in 1969 does not resemble the historic cabin arrangement as shown in the original builder's drawings (Hepple & Co.). All of the woodwork will have to be removed in order to sandblast and coat the hull interior, and it is recommended that the existing interior be scrapped and a new interior installed based on historical evidence of the original accommodations layout. There is good reason to believe that construction of the vessel was faithful to the builder's drawings. However, an attempt should be made to find additional documentation of the interior layout and detailing, possibly through oral histories (it is highly unlikely that any interior photographs were ever taken of a lowly paddle tug).

To allow periodic maintenance of the hull and underside of deck, the new interior should be designed with removable paneling along the hull and overhead.

Restore/Replicate Deck Furniture

The deck furniture includes two wooden scuttles, a steel scuttle, and two steel skylights. None of the scuttles are historic. The steel skylights are not original, but were installed during the historic period. The recommendation is to restore only the skylights, and to replace the wood scuttles with accurate replicas of the original ones. The steel scuttle to the engine room is a nonhistoric addition that should be eliminated when the foredeck is rebuilt.

At first glance, it would appear that wooden scuttles could be retained; they are in fair condition and are reasonably well built. The problem is that they are a major departure from the original accommodations scuttles in both design and orientation. Historic plans and photographs show that the forward scuttle had a sloping top and both scuttles were oriented athwartships rather than fore and aft. The accommodations access ladders were

also positioned athwartships. An accurate reconstruction of the accommodations spaces would therefore not be possible using the existing scuttles.

The steel skylights should be sandblasted and coated, and broken lenses replaced (A tempting option would be to replicate the original skylights, particularly the aft one which appears to have been quite elegant).

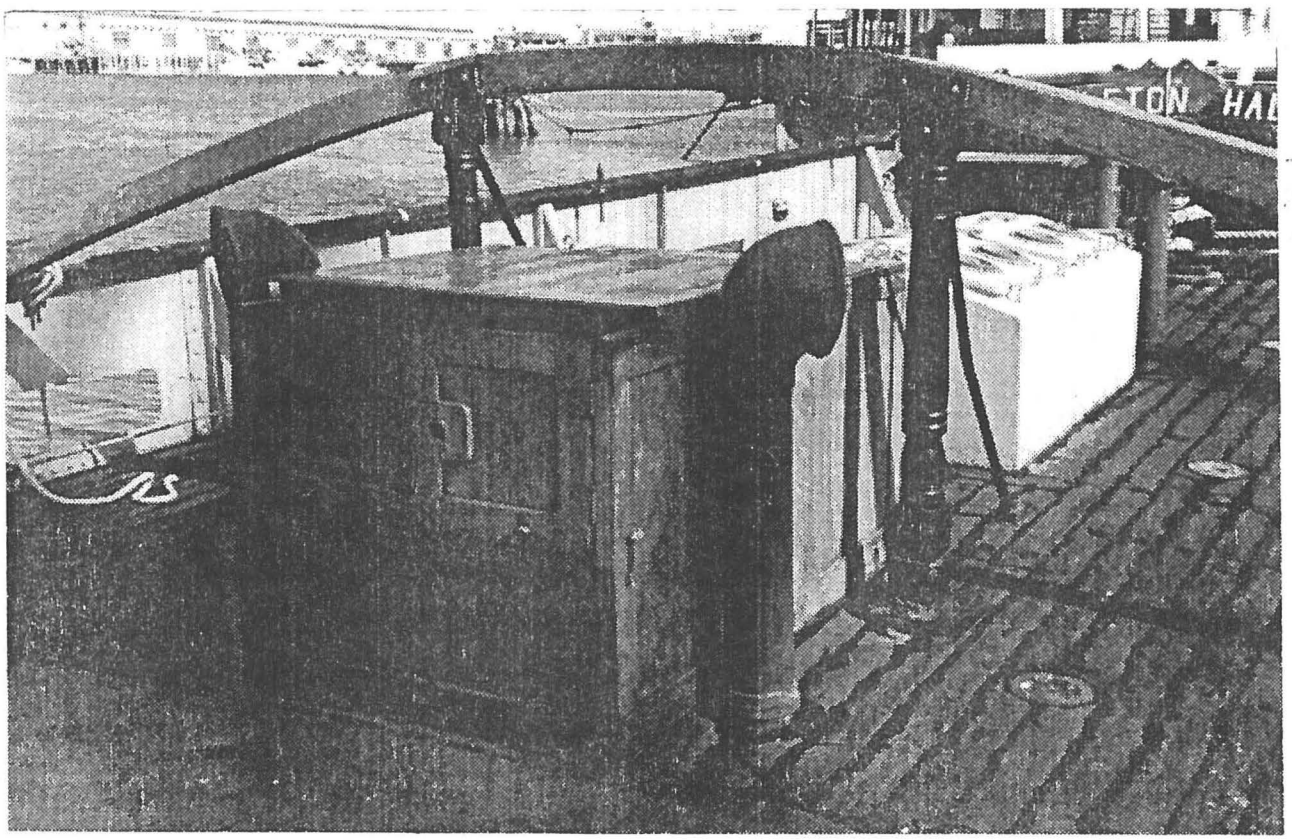


Fig. 17. The scuttle to the aft accomodations, with the aft skylight beyond. Arched structure above the scuttle is the forward towing bar.

Restore Fidley, Pilothouse, and Bridge Deck

Fidley: The fidley is in fair condition and will require little more than surface preparation and painting. A minimal amount of steel repairs may be needed and all three access doors will need to be overhauled.

Pilothouse: The appropriate treatment for the pilothouse is open to debate. It has no historical relationship with the vessel, having been salvaged from a fishing trawler and installed in 1969

(Newhall 1971), but bears a reasonably close resemblance to the original pilothouse. From what can be seen in historic photographs and plans, the original pilothouse was about the same size as the existing one, but had a slightly different shape. Although EPPLETON HALL spent much of her later career with an open box for a pilothouse, the top having been cut off in 1953 or earlier (SFMNHP Photo #I1.24353), it is not recommended that she be restored with an open pilothouse.

To preserve the existing pilothouse, the rotten decking and beams on top will have to be renewed. The nonhistoric access ladder and railing on top should be removed to improve historic appearance. If further survey reveals that more extensive work is required to restore the existing pilothouse, it would be better to expend the effort on replicating the original one. Using the builder's plans and historic photographs, it should be possible to carry out an accurate replication.

Fig. 18. EPPLETON HALL's teak pilothouse. Salvaged from a fishing trawler, it bears a resemblence to the original pilothouse.

Bridge Deck: The recommendation for the bridge deck and bridge wings is to restore them essentially as they are. Alterations

were made in 1969 with the removal of the single access ladder on the forward starboard side of the bridge deck and the addition of two ladders on the aft side, port and starboard. Though not historic, the additional ladders would facilitate public access to the bridge deck and pilothouse; at least one of these should be left in place. The ladder originally located on the forward side should be reinstated.

All of the bridge deck planking will have to be removed in order to preserve the steel fidley top, which is rusting away beneath the planking. The wasted steel supports for the bridge wings will have to be replaced before new planking can be laid down. Some of the railings might be salvageable, but most will probably have to be replaced as well. The ship's bell should be removed from its present location inside the forward railing, and relocated to its historic position atop the pilothouse.

Restore Paddlewheels, Paddle Boxes, and Sponson Decks

The paddle wheels and paddle boxes are among the few features that were accurately restored during the 1969 rebuild. The only apparent change was in the decorative detailing of the paddle boxes. The sponson decks are also believed to be fairly accurate restorations. The paddle wheels, boxes, and sponson decks are now in need of considerable work.

Paddlewheels: Most of the paddlewheel ironwork is historic fabric, the majority of which is probably still salvageable. The wooden paddle buckets are not historic fabric.

The paddlewheel are intricate mechanisms that will be difficult to preserve in sea water unless they are periodically rotated. They should therefore be restored to operating condition. All salvageable ironwork should be sandblasted and coated with a durable anti-corrosive paint system, such as inorganic zinc and epoxy. Any severely wasted pieces should be accurately reproduced. All or most of the wooden paddle buckets will need to be renewed (like tires on a car, paddle buckets wore out and were routinely replaced). To provide cathodic protection for the immersed portions of the paddle wheels, the paddlewheel ironwork should be electrically bonded to the ship's cathodic protection system.

Paddleboxes and Sponson Decks: The paddle boxes and sponson decks contain little historic fabric, with exception of some of the ironwork, such as the paddlebox framing. Restoration will involve replacement of all of the paddlebox wood sheathing and sponson deck timbers (treated lumber is recommended), replacement of wasted ironwork, and sandblasting and coating of salvageable ironwork as specified for the paddle wheels. Optionally, the ironwork could be hot dip galvanized to further reduce maintenance requirements. The original insignias on the outboard face of the paddle boxes, seen in an early photograph (SFMNHP Photo I7.23,738), should be reproduced.

Restore Deckhouses and Boat Decks

The deckhouses and boat decks are original features that are largely unaltered. Restoration will involve the same steps as for the fidley and bridge deck. In addition to minor welded repairs to the deckhouses, major work may be required to repair the steel supporting structure beneath. Following repairs, all steel surfaces should be sandblasted and coated. The boat deck planking will need to be renewed, as it will have to come off in order to sandblast and coat the tops of the deckhouses. Adding a second boat davit to each side is recommended to restore the original boat handling arrangement.

Repair Stack

The stack can and should be preserved; it is historic fabric and is not beyond the point of repair. The major problem with the stack is corrosion and wastage along riveted seams. Perhaps the best way of repairing the stack will be to remove it by carefully cutting it away from the boiler casing. With the stack laid flat, internal welded patches can be installed. Once all welded repairs are made, the stack exterior should be carefully sand swept and painted. The interior of the stack, which will be difficult to sand sweep, can be coated with a soft film protective coating.

The repair and coating of the steam vent pipe and whistle would be part of the stack job. All stack guy wires should be renewed and a secure weather cover fitted over the top of the stack.

Preserve Boiler Casing and Steel Deck

The boiler casing and steel deck over the boilers are in relatively good condition, with only local incidents of corrosion. Preservation would involve spot sandblasting all areas of corrosion and coating all surfaces. Deep corrosion pits and gaps in rivet seams can be flushed off smooth with a metaling epoxy, such as Belzona, before painting.

Preserve Anchor Windlass, Steering Gear, Towing Hooks

Anchor Windlass: The windlass is in poor condition and will require extensive restoration if it is to be effectively maintained in an exposed environment. Ideally it would be made functional so that it could be periodically operated to keep it freed up and lubricated.

The windlass should be removed to a shop where it can be disassembled for internal preservation. Some parts may need to be machined or fabricated, including the cylinder covers which appear to be missing. The exterior should be sandblasted and coated with a durable anti-corrosive coating. For additional protection, a weatherproof fabric cover could be placed over the

windlass when the vessel is not on displayed. Provision should be made for running the windlass on compressed air as a routine maintenance procedure.

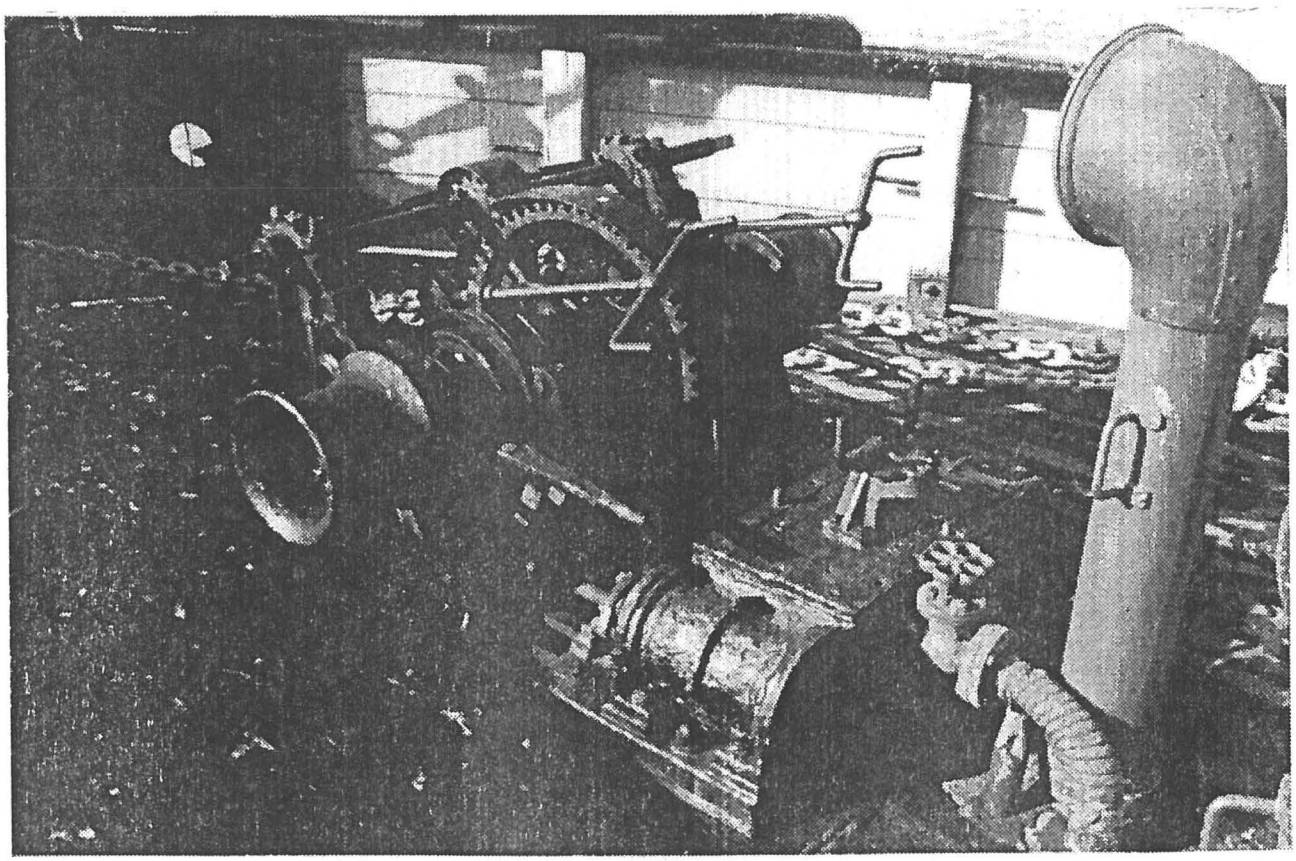


Fig. 19. The steam-powered anchor windlass, an historic element.

Steering Gear: The steering gear is in good condition, having been protected by the pilothouse, and will require little preservation other than cleaning and coating. On the other hand, the steering linkages and rudder head are in poor condition. It is recommended they be completely overhauled to return the steering system to operating condition. All of the rod linkages, housings, and fairleads should be sandblasted and coated. The rudder bearing is a mass of rust and will need to be disassembled for the same treatment. The rudder should be unshipped for inspection and repair during the next drydocking. While the rudder is removed, the rudder trunk should be repaired as needed and coated.

Towing hooks: The towing hooks are original equipment that are not permanently mounted to the vessel. They are presently laying on the main deck where they are rusting away. It is recommended they be removed to Museum storage until restoration is completed.

The towing hooks are interesting features that appear to have been peculiar to Tyne River tugs. Once EPPLETON HALL is opened to the public, the stern towing hook should be mounted in its proper location aft of the stack. The bow towing hook was originally mounted on a pedestal forward of the windlass. The pedestal was scrapped in 1969. As a significant feature of the vessel, it should be replicated and the bow towing hook mounted on it. In order to maintain the towing hooks in an exposed environment, they would need to be sandblasted and coated.

Preserve Deck Fittings

Deck fittings include towing bars, ventilators, and wood and steel bitts. All of these items will have to be removed for renewal of the main deck planking and should be properly preserved before being reinstalled.

Bitts: All of the bitts are historic and are in their original locations. Wood bitts will need to be refinished and steel bitts sandblasted and coated.

Towing Bars: The forward towing bar is partly original fabric and should be carefully preserved. The aft towing bar is a replica dating from 1969, and could be replaced with a more accurate copy of the one visible in a historic photograph (SFMNHP #I1.23463).

Ventilators: There is a forest of ventilators on the main deck (twelve in all) where there was originally only two, one forward and one aft. While the ventilators help to reduce moisture below decks, some of them should be removed to maintain historic appearance. The two engine room ventilators on the bridge deck are historic and should be restored.

Restore Mast and Rigging

The steel mast is extensively corroded, but can probably be retained if it is removed, sandblasted, and coated. The standing rigging is in poor condition and will have to be replaced.

In the long-run, historic integrity would be best served by replicating the original wood mast and rigging it per the original arrangement, including towing lights.

Install Bilge, Electrical, and Alarm Systems

As a floating exhibit, EPPLETON HALL will need reliable systems, including an electrical shore power system, a bilge pumping system, and a fire and bilge water alarm system (as recommended for the stabilization phase). These systems should be designed and installed in conjunction with the interior restoration so that visual impact can be minimized.

Modifications for Public Access

By design, EPPLETON HALL is not well suited for public access below decks. The hull is divided into three major compartments which are not interconnected. Each compartment has only one point of access, other than emergency hatches, and the existing access ladders are steep and would be hard for the public to negotiate. Achieving an orderly flow of visitors through the vessel will therefore be difficult.

There are no easy solution to these problems, yet a meaningful interpretation of EPPLETON HALL will be lacking if the engine room and accommodations spaces cannot be viewed. Drastic measures, such as cutting access holes in the bulkheads, and removing or gutting one of the boilers, would significantly alter the interior layout and are not recommended at this time.

The recommended approach is to take simple steps to make public access easier and safer, such as increasing the tread width and reducing the slope of the ladders to the engine room and accomodations. Traffic flow in and out of these compartment will be somewhat awkward but can be regulated using directing signage. Visitor access to the main deck, bridge deck, and pilothouse should not present any problems.

2-7. Schedule of Implementation and Cost Estimates

The following schedule of implementation is based on the restoration schedule outlined in the NPS Fleet Plan, but has have been edited to reflect changes in the proposed treatment. The restoration is scheduled over an extended period in an effort to reduce the amount of funding required within any single fiscal year.

The sequencing is not particularly logical from a technical standpoint. A concerted start-to-finish restoration would be more efficient, and would have a lower overall cost. In such a restoration, each type of work (scrapping, sandblasting, laying of decks) would be completed throughout the vessel before moving on to the next step. However, such an approach practical only if sufficient funding is available to complete the work without interruption. With more fragmented funding, it is necessary to define the work as a series of small restoration projects, each of which can be carried out to completion with smaller amounts of funding.

The cost estimates given are for work performed by contractors at a standard labor rate of $40 per hour. Work that would be performed in a shipyard is estimated at a rate of $50 per hour.

Stabilization and Planning

Efforts to stabilize EPPLETON HALL's condition (steps 1 and 2) should begin immediately, and should be completed regardless of whether Park management intends to proceed with restoration. Restoration planning (step 3) would not be necessary if a decision is made to forego restoration, though any savings would be partially offset by costs incurred in the process of preparing the vessel for deaccession.

1) Provide access to the vessel, either via floating dock or brow from the pier	- 0 - *
2) Carry out stabilization measures	$ 30,000
3) Begin restoration planning: develop a detailed scope of work; complete all necessary historic research and documentation, produce drawings and specifications needed for restoration	40,000
Total for Stabilization and Planning	$ 70,000

* Cost included in Hyde Street Pier redevelopment budget

Restoration

The following restoration sequence would complete the recommended treatment in six phases, each covering roughly one year. If the vessel has been effectively stabilized, it should be possible to extend the restoration over a six-year period without risking a further significant loss of historic fabric due to deterioration. Restoration would be directed first at those areas where stabilization measures are expected to be only marginally effective.

Phase 1

The first step will be to drydock the vessel to preserve the underwater hull. Additional work that can only be done while in dry dock, including restoration of the paddle wheels and paddle boxes, would be deferred to a later drydocking unless a significant amount of funding becomes available.

After the vessel is refloated, the restoration would focus on preparing the engine room for beginning work on the engines and boilers.

1) Haulout:	$ 9,000
- renew or double an estimated 15% of shell	28,000
- overhaul rudder	2,500
- sandblast and coat bottom and immersed portion of paddle wheels	11,500
- install permanent cathodic protection system	25,000
- refloat vessel	--
Subtotal for Drydocking	$ 76,000
2) Remove planking and deck beams over coal bunkers	2,000
4) Scrap fuel tanks and piping in engine room	3,500
5) Clean and coat hull and bulkheads in engine room	40,000
Total for Phase 1	$ 121,500

Phase 2

The goal of Phase 2 will be to complete restoration of the engine room and preservation of machinery. The engine room could then be opened to public access.

1) Overhaul Engines	$ 60,000
4) Preserve boilers	47,000
2) Restore coal bunker bulkheads	12,000
3) Replicate boiler fire boxes and engine room details	9,500
4) Modify engine room access ladder for public access	6,000
Total for Phase 2	$ 134,500

Phase 3

In Phase 3, the restoration effort would shift to the forward end of the vessel for hull preservation and restoration of the deck and forward accommodations, with the goal of extending public access to the forward accommodations.

1) Remove remaining foredeck planking, mast, windlass, interior joinerwork, and fuel tank under galley sole.	$ 13,000
2) Sandblast (or water blast) forward accommodations area and coat steel deck structure, interior of shell, and bulkheads.	32,000
3) Renew foredeck	19,000
4) Restore wood bulwarks	23,000
5) Install interior joinerwork	34,000
6) Restore/replicate deck furniture on foredeck	12,000
Total for Phase 3	$ 133,000

Phase 4

In Phase 4, the vessel would again be drydocked, this time for completion of the remaining work that can only be carried out efficiently while the vessel is out of water. The amidships deck structures would also be restored at this time.

1) Haulout:	$ 17,000
- overhaul paddle wheels.	32,000
- rebuild paddle boxes and sponson decks	80,000
- refloat vessel	--
Subtotal for Drydocking	$ 129,000
2) Repair and paint fidley and deck houses	10,000
3) Renew bridge deck and boat decks	13,000
4) Restore or replicate pilothouse	17,000
5) Repair wasted areas of stack, sandblast and coat stack, boiler trunk, and steel deck.	20,000
Total for Phase 4	$ 189,000

Phase 5

The aft end of the vessel would be restored in this phase, thus completing the last major work to hull and decks and allowing public access to all areas of the vessel.

1) Remove aft deck, deck furniture, and interior joinerwork.	$ 10,000
2) Sandblast (or water blast) and coat steel deck structure, interior of shell, and bulkheads.	30,000
3) Renew aft deck	11,000

Phase 5 (cont.)

4) Restore/replicate deck furniture, preserve towing posts	14,000
5) Install interior joinerwork	32,000
6) Repair aft steel bulwarks	8,000
Total for Phase 5	$ 105,000

Phase 6

The final phase will complete the finishing touches and any other work that was not completed in the preceding phases.

1) Overhaul steering gear and windlass.	$ 4,000
2) Restore boats and davits.	10,000
3) Install and rig mast.	8,500
4) Install awnings and stanchions.	14,500
5) Complete outfitting and interpretation.	20,000
Total for Phase 6	$ 57,000

Total for Proposed Treatment	$ 812,000

2-8. Impact of Proposed Treatment

The proposed restoration of EPPLETON HALL for use as a floating exhibit should result in an overall improvement in the historic integrity of the vessel. Historic fabric would not be altered; treatment would be limited to that needed to ensure its long-term preservation. The majority of the proposed work would focus on reversing nonhistoric alterations and restoring or reproducing damaged or missing elements. While reproduction is generally not recommended by the National Park Service where it is based solely on conjecture, there is sufficient documentation in the form of physical evidence, plans, and photographs to accurately reproduce most of the significant features that are missing.

The only negative impact the proposed treatment would have on historic integrity would result from efforts to achieve public access, particularly to compartments below deck. This would include modification of the access ladders to the engine room and accommodations spaces. The degree of impact these changes have will depend on the level of sensitivity employed in the design of the access arrangements.

In terms of the impact on the Maritime Park as a whole, opening EPPLETON HALL for public tour would add another major feature to the Park (at present, only three out of the seven vessels of the fleet are regularly accessible to the public) and would likely have a positive effect on attendance. On the other hand, actively interpreting EPPLETON HALL would mean redefining the scope of the Maritime Park to encompass a theme that extends beyond West Coast maritime history. This may, in turn, dilute the established focus of the Maritime Park.

2-9. Recommendations for Further Study

Historic Research

To assure that the proposed restoration is accurately executed, further historic research will be necessary, particularly in the case of elements that have been significantly altered or are missing entirely. Among the subjects for research will be:

- the original pilothouse design and details
- the accommodations layout and construction details
- the design and orientation of missing deck furniture
- details of the missing bow towing post.

In addition to the above, an Historic Furnishings Report, as described in NPS 28 (National Park Service 1985), should be produced. This document would guide the furnishing of the accommodations spaces and the outfitting of each compartment for interpretation. Historic detailing of engine room should also be based on the Historic Furnishings Report. Research will probably have to extend to sources in Great Britain, as historical material from local sources is limited.

Documentation Drawings

To supplement the existing condition drawings produced for the Historic Structure Report, further documentation of EPPLETON HALL through measured scale drawings is recommended. The following additional drawings would complete a comprehensive documentation of the vessel and her machinery.

- Inboard Profile
- Deck Framing Plan
- Hull Framing Plan
- Detailed Mechanical Drawings of Engine, Pumps, and Windlass
- Details of Paddle Wheels and Paddle Boxes
- Details of Deck Structures and Bulwarks
- Hull Lines

It is recommended that the drawings be developed using Autocad, the computer drafting program used to produce the drawings for this report. This method will provide drawings that are far more versatile than those drawn by hand, and at equivalent cost.

Feasibility Study for Operation of Boilers

Restoration of the boilers for operation is not proposed at this time. Nevertheless, the benefits to be gained from steaming the vessel warrant a further investigation into the feasibility of making the boilers safe to operate. The major concern is that they would not meet modern safety standards, even if restored to their original condition. A study would look into the feasibility of using modern technology, such as automated furnaces, pressure relief valves, and circulating pumps, to improve safety without seriously affecting the historic integrity of the boilers.

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3-2. Survey Findings

EPPLETON HALL was surveyed while afloat at her mooring in Aquatic Park in March 1990. Her last out-of-water inspection was performed during drydocking in 1983. Assessment of hull condition is based on visual inspection and ultrasonic gauging of the hull interior.

3-2.1. Hull Structure

Description: The hull is riveted steel construction with transverse framing, a bar keel, and a bar stem and sternpost. The shell arrangement is in and out strakes with flush butts and all internal butt straps. The out strakes are double joggled and lay directly on the frames, with no frame liners. Frames are 2-1/2" x 3" x 5/16" angle on 19" centers amidships, and 21" centers fore and aft of the engine room. Original shell scantlings are 3/8" at the sheer and garboard amidships, and 5/16" for most other strakes. Thickness of the sheer and garboard drops to 5/16" at the ends.

Condition: The hull retains its original form, with exception of minor dents in shell plating. Most hull fabric appears to be original, though small welded plate inserts are seen in various places. The sheer strake in the midship area (approximately frame 14 to 47) is riveted like the rest of the hull, but appears to be a renewal of heavier plate (see Ultrasonic Thickness Readings).

The of the exterior hull is coated with a coal tar epoxy that was applied in 1983. On the topsides, the coating is breaking down and numerous areas of local corrosion and wastage are seen. Condition below the waterline could not be determined, but judging by the topsides, it is probably overdue for bottom maintenance. Although a few zinc anodes are hung over the side, there does not appear to be any effective cathodic protection system.

Condition of the hull interior varies from fair to poor. Ultrasonic gauging of hull plate thickness indicates that overall wastage of the shell is approximately 24 percent. Details of interior hull condition are given in the following sections on the individual hull compartments and date is presented in the ultrasonic readings at the end of the report.

Conclusions: Overall hull condition is poor and will continue to get worse until the vessel is drydocked for coating of the hull interior and exterior. Original hull fabric is being lost to corrosion, and watertight integrity could soon be seriously compromised unless steps are taken to preserve the hull. The installation of an impressed current cathodic protection system is an immediate step that can be taken to slow deterioration of the underwater hull. An effort should

also be made to slow corrosions of the hull interior until major cyclical maintenance can be undertaken. Practical steps include routinely pumping bilges, manually scaling and coating rusting surfaces, and use of lighting or heating rods to reduce moisture inside the vessel.

3-2.2. Forepeak

Description: The forepeak is a small void space that extends from the stem to the collision bulkhead at frame 3. It is only accessible through a small manhole on the upper starboard side of the collision bulkhead.

Condition: Most of the forepeak is coated with a brown epoxy paint. This coating has largely failed and there is now heavy rust scale on the hull and deck structure. Severe wastage is seen on the deck stringer plates, beams, frames, webs, and longitudinals.

Conclusions: The forepeak needs extensive scaling and coating to arrest ongoing corrosion and wastage. Restoration of hull and decks in this area will require renewal of steel deck structure and perhaps portions of the hull structure as well.

3-2.3. Forward Accommodations

Description: The forward accommodations area is abaft the collision bulkhead and extends aft to the watertight bulkhead at frame 14. All of the accommodations interior dates from the 1969 restoration and is light scantling wood fastened with either nails or exposed screws. The hull is ceiled with vertical tongue-and-groove sheathing of about 5/8" thickness, and the overhead (underside of main deck) is sheathed with wood paneling. The area below the accommodation sole is not sheathed and hull structure is exposed. The compartment contains a galley, stores area, and crew berths above the sole, and chain locker and tankage below.

Access to the forward accommodations is via a steep ladder at the aft end of the compartment. To port and starboard of a short passageway are two single berth cabins. Forward of these is the galley, with stove and sink to port, and counters forward and to starboard. At the forward end of the galley is a partial joiner bulkhead, and forward of this, a pantry with athwartship shelves. Two small hatches in the sole give access to the chain lockers below. The chain lockers are formed by 3/8" welded plate bulkheads on centerline and aft side, the side shell and collision bulkhead forming the other two sides. Aft of the chain locker is a free-standing tank, for fuel oil or potable water, mounted between floors and sole, with a narrow crawl space aft and on both sides, but no access space beneath.

Condition: The accommodations interior woodwork is in generally fair condition. Partial removal of ceiling in the galley revealed that the hull had been coated with a preservative fluid film during the 1969 restoration. The film is still tacky and appears, at least in the small area examined, to have been effective in arresting corrosion.

The chain lockers are very corroded, with heavy rust scale on the side shell in particular. The bilge area aft of the chain lockers is in the same condition, with heavy rust scale on shell plating and framing, indicating that the fluid film preservative was never carried below the level of the cabin sole (probably on the sadly mistaken theory that the space below the woodwork could and would be maintained). The engine room bulkhead and the sides of the tank are also covered with heavy scale. The only positive note is that the bilge was almost dry, indicating that the hull does not leak in this compartment, and the deck is not leaking as badly as its appearance would indicate. Ultrasonic readings in the forward accommodations indicate that the lower strakes, A through D, have suffered considerable wastage, while the sheer strake shows only minimal loss of thickness. Overall, wastage averages 25 percent for this compartment.

Conclusions: The hull in the forward accommodations area requires extensive maintenance to arrest ongoing deterioration. Since the joinerwork in this compartment is not historic, nor of any great quality, its removal is recommended in the interest of preserving and maintaining the hull.

The tank should eventually be removed -- it is not historic fabric nor of any use to the vessel, yet makes maintenance of the bilges beneath it virtually impossible. Removal of the tank should be coordinated with renewal of main deck planking, as it will have to come out through the deck.

3-2.4. Engine Room

Description: The engine room extends from the watertight bulkhead at frame 14 to the bulkhead at frame 47. This compartment is the largest in the vessel, and houses the engines and boilers, as well as tankage and auxiliary machinery (it can technically be referred to as the engine-boiler room). The engines are at the forward end of the compartment and the boilers are at the aft end. The bilges in the engine room are coated with cement up to the turn-of-bilge.

At the forward end of the engine room, a U-shaped steel bulkhead forms the coal bunkers. The bunkers extend across the forward end of the engine room, and aft along the hull for approximately 25' on both sides. The aft end of the coal bunker bulkheads have been cut open and the space inside the bunkers is now devoted to a series of twelve free-standing

tanks for fuel and lube oil. all of these tanks were installed in 1969. Small manholes in the bulkheads allow inspection of the paddleshaft packing and the hotwell overboard discharge.

Aft of the forward coal bunker bulkhead is a narrow machinery platform. To starboard on the platform is the landing for the access ladder from the scuttle on the deck above. A duplex fire, bilge, and general service pump is sitting on the platform to starboard, but is not bolted down or connected to any piping. On centerline above the platform is the fire and bilge manifold, with two valves and a strainer. Below the platform are valves to cross connect the bilge and fire pump with the engine-driven feed pumps.

Aft of the platform, the two massive side lever steam engines are positioned side by side, with a narrow catwalk between them. The engines project above main deck level into the fidley, where the engine controls are located.

Abaft the engines, port and starboard are two small single cylinder diesel engines for fuel oil transfer and generating.

Between the main engines and the boilers, a grating runs athwartship about 8" over the floors. The space between the grating and the floors is filled with a maze of fuel oil and bilge piping. On centerline just forward of the boilers, an access ladder ascends to a platform in the fidley. The steam supply pipes are now partially disassembled, but formerly ran overhead between the boilers and the engines and had valves cross connecting them.

The boilers face forward, and are mounted side by side on transverse saddles that are connected to deep web hull frames. Abaft the boilers there is an access ladder and manhole to deck on the port side, and a fuel tank mounted on the aft engine room bulkhead.

Condition: The engine room is generally in a state of neglect and disarray. Some of the machinery has been partially disassembled and parts are laying scattered about. The engines and auxiliaries are either frozen or otherwise inoperable, and the boilers are rusting away both inside and out (see other sections of this report for details on machinery and boilers). The atmosphere in the engine room is very humid and therefore conducive to corrosion.

The hull in way of the engine room shows considerable corrosion, both in the bilges and on the sides of the hull. Corrosion in the bilge areas is the result of bilge water, which appears to remain at least 3" deep. Floors and frames are rusting, and bilge water is sloshing to the turn-of-bilge, where it is corroding the shell plating not protected by cement. The cement bilge coating on the bottom shell sounds hollow in some areas, indicating that bilge water has seeped beneath it. The hull sides and bunker bulkheads are rusting

away in areas where the fuel tanks prevent access for maintenance. Lighting in the engine room is poor and it is difficult to move about or work due to the general disorder.

Conclusions: The engine room should receive priority in any stabilization or preservation effort. Not only is it the largest compartment in the vessel, it houses historically significant artifacts -- the engine and boilers.

Before any major work can be done in the engine room, working conditions will need to be improved. Lighting should be increased, and existing gratings secured (and perhaps additional ones installed) to provide safe working areas. All parts removed from the historic machinery should be identified, catalogued, and properly stored before any further mechanical work is performed on the machinery and boilers.

In the short term, the rate of corrosion can be slowed by reducing the moisture level in the engine room. This can be achieved by keeping the bilges pumped (a small automatic bilge pump will work for this) and by keeping lights burning in the compartment.

As a stabilization measure, accessible hull surfaces should be scaled, treated with a chemical rust converter, and painted. In the long run, tankage will have to be removed to properly coat bulkheads and shell in the coal bunkers.

3-2.5. Aft Accommodation

Description: The aft accommodations occupy the compartment between the aft engine room bulkhead at frame 47 and the stern peak. In terms of construction, they are very similar to the forward accommodations, having also been installed in 1969. The overhead and sides of the hull are sheathed with light scantling wood, while the hull below the cabin sole is bare.

Access to the aft accommodations is via a steep ladder at the forward end of the compartment. On either side of a short passageway are the captain's cabin to port and the chief engineer's to starboard. A small hatch in the sole under the ladder allows access to the bilge pump suction abaft the bulkhead. Another small hatch in the passage gives access to the bilge, where there is a wooden storage flat about 2' below the cabin sole and extending between the two hatches.

Abaft the cabins is a saloon with settees, and upper and lower pilot berths port and starboard. At the aft end of the saloon there is a wide shelf the width of the vessel which may have been used for stores or additional berthing.

Condition: The joinerwork is partially disassembled, but is in fair condition except for the captain's cabin, which shows a considerable staining and warping from chronic leakage of the

rotten deck above. A section of sheathing was removed for inspection of the hull in the saloon area and the hull was found to be coated with a fluid film as in the forward accommodations.

In the bilges below the sole are dry, but the hull is severely corroded, with heavy rust scale on shell and frames.

Conclusions: Hull preservation should be a priority in this compartment, particularly the areas beneath the cabin sole. Stopping leaks in the deck above will slow corrosion of the hull, but long-term preservation may best be served by removal of the nonhistoric interior woodwork to facilitate access to shell and frames. The bilge area is accessible at this time and can be cleaned, scaled, and coated without removing any of the woodwork.

3-2.6. Aftpeak

Description: The aftpeak is at the stern and, like the forepeak, is a void space. This small compartment is separated from the aft accommodations by the transom which appears to be a solid plate bulkhead up to deck level.

Condition: Condition of the aftpeak remains a mystery, as no access was found to the compartment. It appears the only way to get into the aftpeak is by removing deck planking above.

Conclusions: The aftpeak cannot be regularly maintained. At such time as the aft deck planking is removed for renewal of the deck, this compartment should be properly preserved with a long-lasting coating system.

3-2.7. Main Deck

Description: The main deck is 2-1/2" fir planking bolted to steel angle deck beams, except in the area directly over the boilers, where the deck is steel plate.

At the bow, a small triangle area of the deck is cemented. Windlass, skylight, forward accommodations scuttle, and mast are on centerline in that order. The engine room scuttle is aft of the mast and to starboard of centerline.

The deck planking extends aft to approximately amidships, where it butts into the steel deck plating over the boiler. The steel decking is not original (the deck was originally wood planked throughout), but was probably installed when the boilers were renewed in 1946. The steel decking is laid in five longitudinal lap-riveted strakes of 3/8" plate. There is a 30" wide band of welded plate across the aft end, a renewal dating from 1969.

Aft of the steel deck, the wood deck resumes, with a scuttle and skylight on centerline, a set of bitts aft, and the rudderpost and tiller at the stern.

Condition:

Foredeck: Forward of the windlass there are scattered small rot pockets and the plank ends are soft where they butt into the forward boundary bar. The bed under the windlass is moderately rotten. Planking immediately forward and to starboard of the windlass is lifted off its beams by expanding rust scale.

Down the port side, the margin along the scuttle is rotten. The aft ends of the foredeck planking are soft where they butt into the steel boiler deck plating. About seventy-five percent of the bungs are lifting, indicating corrosion of the deck fastenings. Approximately eight of the twenty-four planks on the port side are lifting due to rust expansion on the steel deck beams. This indicated chronic leakage of deck seams.

The starboard side of the foredeck is virtually the same as port side but the lifting of planks is more severe. The starboard margin plank is rotten just forward of the paddlebox.

Midships steel deck: There is deep pitting in the steel deck plating overall, with crevice corrosion along the riveted seams. The deck has been badly buckled, probably the result of fire, and has about 4" of waviness, particularly aft. The steel boundary angle to boiler casing is in good condition as is the gunwale angle to sheer strake connection. Except for the riveted seams, the coatings are holding up reasonably well.

After deck: The wood deck aft is generally in better condition than the foredeck, having the same problems, but to a lesser degree. The plank ends are soft all the way across the aft end of the steel deck plating. The margins are soft around the scuttle. There are numerous small rot pockets and about 40% of the bungs are lifted, indicating corrosion of fastenings. The margin plank and plank ends across the stern are lifted by rust scale. The worst area of rot is forward on the port side, over the captain's cabin. This corresponds to the water damage seen in the aft accommodations.

Conclusions: In the short term, the foredeck deck is worth caulking and paying in an attempt to improve watertightness and slow decay. The deck is not beyond repair, though it would require removal and replacement of numerous planks. In the long run, renewal of the entire deck would be preferable because it would allow removal of the useless and nonhistoric fuel tanks, and scaling and coating the shell, frames, and deck beams.

The wood deck aft is still salvageable with repairs or limited renewals. The deck can be made watertight by driving down the existing caulking and paying the seams with pitch. Rotten areas will have to be patched or repaired to achieve watertightness.

The steel decking is not in need of renewal or major repairs. The corrosion along seams can be arrested by chipping out the scale and filling them with an epoxy seam compound.

3-2.8. Forward Bulwarks

Description: The first four feet of bulwark aft of the bow are welded steel with wood sheathing. There are hawseholes, port and starboard. The rest of the forward bulwarks, aft to the paddle boxes, are wood. There are hinged gates in the bulwarks just forward of the paddleboxes. The bulwark stanchions are oak (4-1/2" molded x 5" sided) set in cast iron bases which are bolted through the deck. Bulwark planking is piranha pine, and in two layers. The outer planking is 1-1/4" thick and is finished bright; the inner layer is 1" stock and is painted. The cap rail is 2-1/4" x 7" oak.

Condition: Port, reading from fore to aft:

Stanchion no. 1 split at top, rotten at base
" no. 2 soft at base
" no. 3 fwd face rotten, soft all around base
" no. 4 soft at checks on upper half and at base
" no. 5 incipient rot at base
" no. 6 rotten at base
" no. 7 split at top, rotten at base
" no. 8 very rotten from top to bottom
" no. 9 (blocking fwd of the paddlebox) rotten inside

Starboard, reading from fore to aft:

Stanchion no. 1 incipient rot at base
" no. 2 split top to bottom, soft at base
" no. 3 rotten at top under rotten in cap rail
" no. 4 hollow sounding from top to bottom
" no. 5 incipient rot at base
" no. 6 soft from cavil cleat down to base
" no. 7 soft from cavil cleat down to base
" no. 8 rotten and split at top, soft at base
no. 9 internally rotten, soft at paddlebox

Bulwark planking has been coated within the last three years, but the planking is warped from weather exposure. All screw heads are exposed, rather than countersunk, and are rusting. Planking is rotten between hawseholes and in way of the port bulwark gate just forward fwd of the paddlebox. The gate hinges are almost completely rusted through and the lower one is broken. Starboard bulwark planking is rotten at butts in way of stanchion no. 3, and at the bulwark gate.

The bulwark cap rails are soft or rotten around checks, fastenings, and bored holes. All joints are open from shrinkage.

The bulwarks plating at the bow is rusting and welded stiffeners have broken loose due to expanding rust scale. The outer face of the planking is hidden by the wood sheathing and cannot be viewed.

Conclusions: The forward bulwarks are not an immediate liability to the vessel or personnel, but the consistently poor condition of the stanchions suggests that renewal of the entire assembly would be the best course in the long run. Ideally, renewal of the bulwarks would not be undertaken until after the main deck is renewed. In the meantime, the life of the bulwarks can be prolonged by use of wood preservatives, and by sealing checks and seams with soft seam compound.

3-2.9. Aft Bulwarks

Description: The aft bulwarks, those aft of the paddleboxes, are steel. They were originally of the same wooden construction as the forward bulwarks, but were replaced in steel during a later refit. The bulwarks are 1/4" plate fitted with 3" x 3" x 1/4" angle stiffeners on 42" centers. The bulwarks are further stiffened by angle bar and flanged plate stays that are welded to the steel deck forward and bolted through the wood deck aft. Around the stern, the plate is doubled and there are mooring rings port and starboard.

The rail cap is a single bulb angle bar riveted to the top edge of the bulwark plating. Aft of the tow bar, the cap rail is supplemented with a welded oval section chafe pad. The bulwarks are riveted to the hull gunwale bar in way of the steel deck, and are welding directly to the top of the sheer strake on the after planked deck. The bulwarks are a mix of riveted and welded construction.

Condition: The bulwarks have seen hard service, as evidenced by numerous dents. but remain intact. Details of condition are as follows.

Port bulwarks, reading from fore to aft (location denoted by stiffener/bulwark stay angles):

Stiffener no.1 rust bulged at base, stay rusted to feather edge
" no.2 rust bulged at base; stay and freeing port rusted to feather edge
" no.3 fair condition, very little rust bulging
" no.4 bulged at base; freeing port feathered top and bottom edges; gunwale bar rust bulged at scupper
" no.5 bulged at base, butt strap rusted through

" no.6 (at start of wood deck) plate bulged off of gunwale bar
" no.7 rust scale between stiffener and plate
" no.8-10 flanged plate stays, lower half rusted thin
" no.11 same as above; freeing port rusted through around lower edge.
" no.12 flanged plate stay in fair condition

Bulwark plating is very thin due to previous corrosion. Rust scale has separated the plate from the gunwale bar from the forward end of the bulwarks to the no. 3 stiffener, and at local spots aft of this. From the no.6 stiffener aft, there are numerous corrosion holed and lacy spots along the lower 25% of the plating. The condition of the gunwale bar under the deck planking is not known and cannot be ascertained without removal of planking.

Starboard bulwarks, reading from fore to aft:

Stiffener no.1 fair, freeing port rusted at edges
" no.2 rust bulged at lower 6", plate wasted around gunwale bar outboard rivets
" no.3 wasted at base, freeing port rusted to feather edge, rust bulging at joint to awning stanchion bracket and around scupper.
" no.4 joint to steering guide broken, rust bulging at lower 4" of butt strap
" no.5-6 rust scale behind entire length, stay angle wasted at base, stanchion base breaking away
no.7 same as no.5, plate rusted to feather edge around freeing port and rusted through at deck
no.8 scale behind lower half, plating rust bulged at butt strap and holed at deck edge
no.9 same as no.8, numerous small rust holes in plate
no.10 rust bulged whole length, steering guide has broken weld, rust holes at lower edge of plate
no.11 numerous rust holes in plate

The bulwark plating around the stern is generally in fair condition. Plating is thin in way of the sheaves for the steering chains, and there are numerous small rust holes in the lower third of the plating.

Conclusions: Although the aft bulwarks are in poor condition, they are not unsafe to personnel and there is no pressing need for repair or renewals. While not original fabric, the aft bulwarks are part of the vessel's working history and are therefore worth preserving. Long-term preservation would include limited steel repairs, sandblasting, and coating. In the short term, efforts should be made to arrest deterioration by sealing rusting seams and coating local areas of corrosion.

3-2.10. Paddleboxes and Deck Houses

Description: The paddleboxes are of wood and steel construction and are supported by the sponson beams fore and aft of the paddlewheels, and by the spring beams (wood and steel trusses outboard of the paddlewheels). The boxes are formed by four semicircular arches of 4" x 4" x 3/8" steel angle crossplanked with 2-1/2" x 5" planks secured by a 3" x 1/4" flat bar straps bolted through the angles. The bulkhead along the inboard side of the paddleboxes has a single door and is 3/16" steel plate, stiffened by 2-1/2" x 1/4" angles at the door, and by 3" x 6" x 1/4" angle across the length. The outboard face of the boxes are an open grill of decorative woodwork in a sunburst pattern. On top of the paddleboxes are the bridge wings, with ladders leading down from the top, fore and aft.

Located on the aft side of the paddleboxes are small steel deckhouses which contained the heads and bosun's locker. The houses were originally wood, but were renewed in steel during 1969 Rebuilt the ~~vessel's working life~~. The boats were carried in chocks on the tops of the these houses, which are approximately one-half the width of the paddleboxes.

Condition, Port: The inboard steel bulkhead is a thin lacework of rust holes. The door frame and internal angle stiffeners are almost completely rusted away. This is mostly the result of years of paddle spray, but corrosion is ongoing.

The head is a patchwork of riveted and welded repairs. The deck plate inside the head has numerous rust holes and the lower hinge of the head door is broken.

The planking of the paddlebox is severely rotten and the ladders are missing treads and unsafe.

Condition, Starboard: The inner bulkhead is thin with numerous rust holes, but is in better condition than the port side. The head bulkhead has been partially renewed with 1/4" plate, though the weld is breaking away from the frame angle around the top perimeter due to expanding scale.

Planking of the box is also severely rotten, and ladder treads are either missing or unsound. The outboard woodwork in the sunburst is generally sound with only a few rot pockets.

Conclusions: Both paddleboxes will need to be completely rebuilt. Rebuilding will not result in a major loss of historic fabric as the boxes were extensively rebuilt in 1969. Although they are in no immediate danger of collapse, the paddleboxes are considered unsafe to climb on. In the vessel's laid up state, they are a low priority. Their eventual collapse can be postponed if steps are taken to treat rot and rust, and apply some paint.

3-2.11. Paddlewheels

Description: The paddlewheels are of the feathering type, with wooden paddle buckets mounted on what appear to be wrought iron frames of concentric rims and connecting rods. Each paddleshaft is supported by a steady bearing mounted on bracket riveted to the hull. An external stuffing box and shaft gland are mounted outboard of the bearing and serviced from within the paddlebox. There is no shaft bearing outboard of the paddlewheel. The paddlewheel feathering gear is anchored to the spring beam outboard, but the beam does not take the weight of the shaft and wheel.

Condition: Both paddlewheels were sandblasted and painted, and the buckets renewed during the 1983 yard period. The coating is beginning to break down and surface rust is appearing. The underwater portions are covered in marine growth and their condition is uncertain. The paddlewheel frames have lost a fair amount of material to corrosion over the years, but are not yet in need of renewal.

Conclusions: Considering that the engines have not been turned over in years, and may not be for many more, there is no point in allowing the lower half of the wheels to corrode away through continuous immersion. Portions of the wheels above the water are also corroding and are difficult to access for maintenance. The best way to preserve the paddlewheels in the short term will be to disassemble and store them in a secure place aboard the vessel, or ashore. This should only be done after thoroughly documenting and tagging of pieces.

3-2.12. Sponsons and Guards

Description: The sponsons are triangular platforms located fore and aft of the paddleboxes. They consist of loose fitting wood planks that form a grating between the hull and the timber guard that runs fore and aft of the paddleboxes. The sponsons and paddleboxes are supported by steel sponson beams that project out from the shell and are stiffened by round bar and angle stays.

Condition, Port: The port sponsons and guards fore and aft of the paddlebox have been damaged by collision and are coming apart and sagging. The center section of the guard outboard of the paddlebox, is in three short pieces as a result of stopgap repairs. All guard timbers are rotten and fastenings corroded.

The spring beam is bowed in, which means the paddlewheel feathering shafts attached to it are probably bent. The lower member of the spring beam truss is split off its fastenings and displaced inboard.

The forward steel sponson beam has large rust holes through the web, despite earlier welded patches. The after beam is

also holed and the flanges of the reverse angles are feather edged and generally wasted. The wood gratings on the sponson decks fore and aft are rotten and should only be trod on with caution.

Condition, Starboard: The outer guard timber in way of the paddlebox is moderately rotten below its steel fender strap. The inner guard timber is rotten in pockets and checks along the top surface, but is sound underneath. In general the starboard side is less rotten than the port side. This can be attributed to its relatively more sheltered position on the lee side in the vessels previous mooring arrangement.

The spring beam is rotten at the ends on the outboard face, and around the fastenings for the feathering gear anchor plate. It also sounds hollow along the inner face and is soft in the checks. The lower member and center block of the spring beam is sound, but the forward spacer wedge is missing and the wedge aft is askew. The flanges of the after steel sponson beam, and the bracket aft of it, are severely corroded. The wood gratings are rotten and small pieces are falling off, though this deck is in better condition than on the port side.

Conclusions: Both sponsons will require extensive work. The starboard side may prove repairable but the port side should be renewed in its entirety. The steel sponson beams are very wasted but will probably suffice for static museum use. Any plans to steam the vessel would warrant a much closer examination of these beams, which may result in a recommendation for renewal.

3-2.13. Engine Room Fidley

Description: The fidley is of riveted steel construction, with steel doors on port, starboard, and forward sides. There are two portholes on each of the four side bulkheads. Inside there are small gratings across the forward and aft ends, with a ladderway descending down from the aft grating to the engine room. A catwalk runs along centerline between the engines and connects the two gratings. The engine controls and steam shut off valves are worked from the aft grating. There are two skylight hatches over the aft end of the fidley.

Condition: The fidley bulkheads are in good condition. One porthole is broken. The doors are out of alignment and the dogs are difficult to operate. The overhead plating around the skylights is rusted and sagging.

Conclusions: The fidley is in better condition than any other part of the ship and does not present any immediate problems. The leaking overhead and badly fitting doors are allowing rainwater into the engine room, but this problems is not difficult to correct. The worst deficiency seen is the rusting plate around the skylights. A plywood cover has been placed

over the area in an attempt to keep rain out, but in the long run, structural repairs will be needed. The doors and port holes should be overhauled or repaired as needed to make them operable and weathertight.

3-2.14. Boiler Casing

Description: The boiler casing is a low trunk immediately abaft the fidley. It is of riveted steel construction and stands about 18" above the deck. The purpose of this small structure is to give sufficient height for the boiler uptakes to rise together and meet the stack. The stack is riveted to the top of the casing. On the after side of the casing, the forged eye for the tow hook projects through an aperture in the stack plating. The tow hook rode on the flat top of the casing abaft the stack. Flush manholes port and starboard give access to the boiler inspection plates below.

Condition: Like the fidley, the boiler casing is in fairly good condition. The only deficiency noted is the heavy rust scale along the forward boundary bar at the base of the stack.

Conclusions: The priority here is stopping leakage around the boiler inspection manholes and at the base of the stack.

3-2.15. Stack

Description: The stack is a steel tube, 6' in diameter and rising approximately 26' above the boiler casing. It rakes aft about 5 degrees. The stack is doubled-walled, with and inner tube and an outer tube. The outer tube is of 3/16" plate in four section, with internal riveted butt straps connecting each section. At some point in the past, the upper two sections have been cut apart and repaired by welding. There are four wire guys supporting the stack. There is a steam vent pipe running up the forward side of the stack and a steam whistle is mounted forward of the vent pipe. A rain cover has been placed over the top of the stack.

Condition: The inner stack tube could not be accessed and was not inspected. The vertical riveted seams in the outer tube are bursting open due to rust expansion. This condition is particularly severe on the port side, which is continuously exposed to the westerly winds. There are numerous rust holes in the outer stack, particularly around the base. The wire guys are very corroded, as are the threads on their bottle screws. The steam whistle is frozen and the insulation on its supply pipe is coming apart.

Conclusions: The portions of the stack that could be viewed appear to be in salvageable condition. To slow ongoing corrosion in the outer stack tube, rusting seams should be sealed to keep water out. Use of sheet metal flashing and

flashing cement would be an effective short-term repair. As part of any long-term restoration, the stack would need to be removed for rebuilding.

3-2.16. Bridge Deck

Description: The bridge deck sits atop the fidley and has bridge wings that extend out to the tops of the port and starboard paddleboxes. It is a planked deck with steel deck beams that are welded to the inboard paddlebox bulkheads and the sides of the fidley. The deck is enclosed by a pipe stanchion and roundbar rail. THe stanchions on the bridge deck are solid stock, while those on the bridge wings are hollow tubing. Abaft the planked portion of the bridge deck is a steel ventilation shaft with two engine room skylights on top.

Condition: The bridge deck over the fidley is weathered, but appears in generally fair condition. There is rust scale between beams and planks. The scale is lifting three planks on the starboard side, at the after end of the fidley. Planking is mostly sound, with only a few scattered rot pockets. The majority of bungs are starting to lift, indicating rust scale buildup on the bolt heads. Like the main deck, the bridge deck has been paid off with plenty of excess pitch, but cracks have formed in pitch and the seams will probably leak.

The bridge wings are in poor condition. Planking is missing on both port and starboard wings and the steel frameworks that support the planking are rusting away. One of the handrail stanchions on the port bridge wing is rusted through and disconnected; all others show deep pitting and scale, and can only be considered marginally safe.

The engine room skylights are rusted out around the rims. A temporary plywood weather cover has been placed over them in an effort to keep rain out.

The starboard running light box is coming apart at the joints and the port box is rotten and falling apart. The running lights are not aboard.

The bell is no longer in its mount on centerline, and is hopefully in safe storage.

Conclusions: The bridge deck still appears salvageable, though the planks that are lifting to starboard would need to be renewed. Rot pockets in the deck planking can probably be successfully treated with wood preservative and sealed. The lifting bungs should be removed, the scale removed from bolt heads, and new bungs set in epoxy. As with the other decks, the bridge deck will need to be bumped down and payed off with pitch (a portion of the deck appears to have been so treated in the last year or two).

The bridge wings will have to be rebuilt, including renewal of all planking. The handrails should be renewed on the port bridge wing, but can probably be repaired elsewhere.

3-2.17. Pilothouse

Description: The pilothouse is mounted on the bridge deck. It has a square aft end and a hexagonal front. There are doors port and starboard and windows on all sides. Construction is teak paneling on a teak sill, with a fir deck on top. A athwartship stair gives access to the pilothouse top, which is surrounded by a handrail.

Inside the pilothouse is a wooden ship's wheel and a Kelvin dry-card type binnacle. There are two engine room telegraphs, one for each engine. All navigation equipment has been removed. A mahogany chart table with drawers is located at the aft end of the pilothouse, and a battery charger is mounted on the bulkhead above. There is evidence that built-in furniture has been removed from the aft corners of the pilothouse.

Condition: The pilothouse is in fair condition, but is deterioration due to insufficient maintenance. The sill joints are is still tight, but the panel joints have opened up along their vertical seams. The pilothouse top leaks freely, despite recent attempts to seal seams with pitch, and most of the planking is now severely rotten. Deck beams #1 from forward has rot pockets along the tops, and beams #2 and #3 are severely rotten. The handrail on the pilothouse top is intact, but weak, especially on the port side.

The wheel is intact and still connected to the steering linkage. Both telegraphs operated, but are stiff.

Conclusions: The roof of the pilothouse needs to be repaired or at least covered to prevent further rapid deterioration. Open seams in the sides will need to be sealed. For any long-term restoration program, other than one requiring authentic reconstruction of the original pilothouse, the present pilothouse can probably be repaired, rather than renewed.

3-2.18. Boat Decks

Description: The boat decks form the roofs of the heads and bosun locker compartments adjoining the aft ends of the paddleboxes. They are planked with the same material as the bridge and main decks. Elevation of these decks is about a foot lower than the tops of the paddleboxes. A set of boat chocks is mounted on each deck.

Condition: On the port boat deck, the forward margin plank abutting the paddlebox is severely rotten. All other planking is in fair condition. The seams have been payed with excess

pitch, but cracks are forming in the pitch. Several bungs are starting to lift due to corrosion of fastening.

The port after boat chock is split and all ironwork is rusted and frozen. The chocks are otherwise in fair condition (see section 3-2.25. for condition of davits).

The starboard boat deck is in almost identical condition, although the chocks are slightly better condition.

Conclusions: These decks are presently salvageable, but probably need to be caulked (to determine this, pitch should be scraped away for inspection of oakum). The rotten margin plank noted on the port side will need to be renewed.

3-2.19. Engines

Description: The main engines are original to EPPLETON HALL and are of a rare type known as the side-lever or "grasshopper" engine (due to the similarity between the side levers and a grasshopper's legs). Each engine has a single vertical cylinder with a jet-type condenser beneath. The pistons activate the side levers via dual connecting rods. The side levers turn the paddle shaft, which has a clutch that allows the paddlewheels to be operated independently or in unison. Each engine has a condensate pump, a feed water pump (both driven by the side levers), and a hot well. The engines have case iron or cast steel frames and foundations and they rest on steel I-beam engine beds.

Condition: The engines appear intact and mostly complete, but show signs of neglect. Numerous pieces have been removed and are laying about the engine room in a haphazard fashion. There is surface rust on much of the exterior and both engines are frozen and cannot be turned over. The cylinder head of the starboard engine has been unbolted in an apparent effort to inspect or free up the engine. Internal condition of the engines could not be determined at the time of survey. There are no records of maintenance performed on the engines subsequent to the vessel's last period of operation in the late 1970s. It is possible that the engines were not properly prepared for lay up and that salt water condensate has remained in the cylinders since that time.

Conclusions: Due to the historical significance of the engines, their preservation should be a top priority. Reducing moisture and improving working conditions in the engine room will be prerequisites for effective preservation and maintenance of the engines. All parts presently removed form the engines should be identified, documented, and either placed back on the engines or properly stored. Any further efforts to overhaul the engines should be guided by a well defined preservation plan with established goals.

For short-term stabilization, exposed metal surfaces of machinery should be greased, oiled, or coated with fluid film as appropriate. The main cylinders should be filled with oil, as should the cylinders of the engine-driven auxiliaries (condensate pumps, boiler feed pumps), in order to arrest corrosion in areas where salt deposits may remain. An effort should be made to free up the engines. This will not only benefit preservation of the engines, but will allow rotation of the paddle wheels which are presently rusting away in the area that constantly remains below the waterline.

Whether or not the engines are ever operated again, they should be completely overhauled and returned to operating condition, as this is the best means of ensuring their long-term preservation.

3-2.20. Boilers

Description: The boilers presently in EPPLETON HALL are original, but were manufactured (by Riley Boilers Limited of Stockton-on-Tees, England) and installed in 1946. They are an archaic type and believed to be nearly identical to the original boilers. They are two-furnace, return-flue, scotch boilers designed to run on sea water with a working pressure of 35 pounds. They were originally coal fired, but were converted in 1969 to run on diesel fuel. The coal furnaces were removed and a single fuel oil burner installed in the center furnace of each boiler, the outboard furnaces being blanked off with steel plates. Each boiler is connected to a thru-hull valve for blow-down, and to feed water piping from the engine-powered feed pumps. There is a single steam line between each boiler and the engine in front of it . A crossover steam line allows each boiler to provide steam to either engine. The boilers are riveted steel construction; steam lines are copper.

Condition: The boilers are severely corroded, inside and out, and do not appear to have received any maintenance in several years. There is no evidence of coatings, paint or otherwise, on the boilers. Both boilers are presently dry, having been drained of feed water in recent years. The steam lines appear in fair condition, but most have been disassembled. The steam line between the starboard engine and boiler has been removed and is laying the firebox of the boiler. The port steam line is partially disassembled, as is the crossover steam line. All thermal insulation was removed from the boilers during drydocking in 1983. The boilers were also inspected in that year, by surveyors from the Hartford Steam Boiler Company, and were considered condemned unless major repairs were made. The extent and cost of repairs were not determined.

Conclusions: Like the engines, the boilers are significant artifacts that should be preserved. A first step in slowing deterioration of the boilers will be to reduce the level of

humidity in the engine room using methods mentioned previously. The next step will be to remove rust scale and apply protective coatings, both inside and outside the boilers. This will be a difficult task because access to most surfaces is limited. In addition, the interior surfaces may be chloride contaminated as a result of years of exposure to sea water with a high salt content (The amount of salt in sea water is normally about 1/32, but the salinity of the feed water would increase as it was repeatedly condensed, and was often not replaced with fresh sea water until it reached 3/32). If chloride contamination has occurred, it will have to be chemically neutralized to prevent further deterioration of the interior.

For immediate stabilization, the boilers can be sprayed with a chemical rust converter such as phosphoric acid. This will slow corrosion, but is not a long-term solution. For long-term preservation, the most practical method may be to temporarily remove the boilers from the vessel, thus allowing sandblasting and coating of the boilers, as well as the hull in way of the boilers.

3-2.21. Auxiliaries Machinery

Auxiliary equipment includes items of machinery such as pumps and generators. Pumps that operate directly off the engines (vacuum pumps, feed pumps) are covered in the section on the engines. Most of the auxiliary equipment that is not integral with the engines was installed during the 1969 restoration and is not historic. The following items are presently aboard the vessel:

Diesel-driven Fuel Pumps (2): These are small single-cylinder Lister diesel engines mounted on platforms just aft of the engines, port and starboard. Both engines are intact, but do not appear to be operable. Only the port engine still has a fuel pump attached, the starboard pump having been removed. There is also a small electric pump mounted on the port platform, adjacent to the diesel pump.

Fire and Bilge Pump: This pump is a horizontal duplex steam pump used to pump bilges and to supply sea water to the fire system. It is located on the platform forward of the engines, and is not mounted or hooked up to any piping. It is not known where the pump was originally mounted or whether it was part of the vessel's inventory during her historic period. The pump is no longer operable; it has been partially disassembled and the pump casing is cracked.

Conclusions: The diesel pumps are no longer of any use to the vessel (there is a possibility one could be converted to an emergency bilge pump, but this will probably be more trouble than it is worth) nor are they historically significant. As part of the clean up of the engine room, it is recommended these diesel pumps and their platforms be removed and the

space they occupy converted to working space by installing gratings.

The fire and bilge pump may be historic fabric, but cannot be repaired or properly preserved where it sits. It should therefore be removed to protected storage.

3-2.22. Tankage

Description: There are a total of fourteen tanks in the vessel, thirteen in the engine room and one below the forward accommodations. Most of the tanks are for fuel; all were installed in 1969. The tanks are non-integral with the hull. Shut off valves for the tanks project above the main deck along the paddleboxes, and vents and sounding pipes are clustered near deck furniture.

Condition: All of the tanks are heavily rusted on exterior surfaces. Internal condition could not be determined. The shutoff valves are frozen, at least to hand operation. The same is true for all sounding pipe plugs.

The contents of each tank, both level and type of liquid, is not known. Documentation indicates that when the vessel was last in service, only the tank on the aft engine room bulkhead was to be used for fuel oil. By request of the U.S. Coast Guard, all others were to be disconnected from the fuel oil piping system and converted to water ballast. This can only be confirmed by sounding the tanks.

Conclusions: The tanks are now a liability to the vessel. They have deteriorated to the degree that leaks could develop, thus allowing oil or oily water to drain into the bilge where it will be difficult to remove. Furthermore, several of the tanks block access to the hull, thus preventing much needed maintenance. It is recommended that all tanks be drained of their contents in the near term. In the long term, the vessel would be best served by removal of all tanks, except the two mounted on the aft engine room bulkhead (these are the only tanks approved for use by the U.S. Coast Guard in the 1970s).

3-2.23. Mast

Description: The foremast is a welded steel spar which steps on the keel. The mast is not original (the original mast was wood) but dates from a later period, perhaps from the 1969 rebuild. It is stayed with wire rope rigging: a double headstay, two pairs of shrouds, and double backstays.

Condition: There is local pitting on the mast exterior. The interior is heavily scaled (determined by striking the mast with a hammer and listening to the cascade of rust scale inside). The rigging is in poor condition. The service is dry and the ratlines rotten. All rigging that is not served is

covered with rust scale and the threads on all the bottle screws are corroding. Most of the starboard ratlines have parted and those remaining appear to be rotten. Due to the unsafe ratlines, the mast was not inspected aloft.

Conclusions: The mast and rigging are not a preservation priority, but should be maintained for reasons of safety. The mast should be scaled and coated. All wire rigging that shows significant corrosion should be replaced. Ratlines should then be replaced to allow routine inspection of the mast and rigging aloft. Since the rigging would be replaced for safety reasons only, it does not have to be served or spliced, but can be bare galvanized wire with cable clip eyes.

3-2.24. Deck Furniture

Deck furniture includes scuttles and skylights as follows:

Foredeck Skylight: The foredeck skylight is located on centerline aft of the windlass. It is welded steel construction, with two hinged covers, each cover having two fixed portholes. The skylight is not original, as evidenced by its welded construction, but photographs date it from the historic period. The skylight is presently painted a buff color. Condition is fair, with local corrosion on the covers and deep pitting around the base. The dogs for securing the covers are missing, as is one of the glass porthole lenses.

Forward Accommodations Scuttle: This scuttle is located just aft of the skylight and is of solid teak and teak plywood construction. It was installed in 1969 and is a somewhat ungainly, non-original design. With the exception of loose hinges on the doors, the scuttle is in fair condition, including the varnish work.

Engine Room Scuttle: The engine room scuttle is located aft of the mast and to starboard of centerline. It was also installed in 1969. It is of welded light-gauge construction, with a sliding steel cover and double doors. It is heavily corroded on top and around the base. The doors are warped and cannot be secured.

Aft Accommodations Scuttle: The scuttle to the aft accommodations is located on centerline, aft of the steel deck. This scuttle is similar to the forward accommodations scuttle in design and construction, except that it has a flat rather than arched top. It was also installed in 1969 and is non-historic. Condition is good.

Aft Skylight: The aft skylight is a larger version of the foredeck skylight, being of the same design and construction, but having four hinged covers, each with two fixed portholes. This skylight is also corroded around the base and on top. Most of the glass lenses in the fixed portholes are broken.

Conclusions: As historic fabric, the skylights should be scaled and coated to prevent further wastage, and repaired as needed. Being nonhistoric, the scuttles are not a preservation priority, but should be maintained in a weathertight condition to keep rain water out of the hull.

3-2.25. Equipment and Fittings

An inventory of equipment presently aboard EPPLETON HALL is given below, with description and condition of each item.

Windlass: The windlass is probably part of the vessel's original inventory. It is powered by a two-cylinder horizontal reciprocating steam engine. Manual operation is by rotary crank. The windlass is stiff and can only be rotated with difficulty through about 220 degrees. The engine is partially disassembled, with the ends of the steam cylinders missing and nowhere in evidence. Moving parts are not lubricated, and the entire windlass is spotted with corrosion. The bed planks beneath are rotten.

Anchor Davit: Mounted on port bulwarks at bow. Gate is frozen in socket and is missing keeper.

Steering Gear: Within the pilothouse, the geared steering mechanism is still lubricated and functional. Along the main deck, the linkage is by means of rods. These are in very poor condition with most bent as well as corroded. The fairleads are generally in haphazard alignment as their brackets rust off of the bulwarks. The system is intact, but would need a complete overhaul before it could utilized or properly maintained.

Steel Bitts Forward: At bulwark stanchion no. 3, port and starboard, are single-post cruciform bitts on hardwood pads. The fastenings appear sound, though none were withdrawn for inspection. The wood pads beneath are cracked and show incipient rot.

Steel Bitts Aft: Abaft bulwark stiffener no. 11, port and starboard, are double-post bitts, with 4" x 8" posts, on hardwood pads. These appear in good condition.

Aft on centerline, mounted athwartship just forward of the rudder bearing, one "H" bitt with 4-1/2" x 18" posts and set on a hardwood pad. The pad is getting soft at the checks, but otherwise sound.

Wood Bitts Forward: Between bulwark stanchions 4-5, single-post oak bitts, port and starboard, 8" square x 48" high with chamfered edges and a rounded top. Posts are set in cast iron sockets bolted through the deck and stayed by three forged iron bars bolted to the deck and attached to a clamp band on

the post at caprail level. A steel collar at the caprail keeps lines from dropping down.

The bitt post on port side is badly checked and rotten in way of the caprail. The starboard bitt post is hollow sounding in way of the caprail, rot is incipient elsewhere along the length.

Wood Bitts, Aft: Abaft bulwark stay no. 4, port and starboard. These bitts are identical in design to those forward.

The port bitt post is hollow at the top and has many checks. The base is still solid. The starboard bitt post is checked but not yet rotten. The rope collar is rusted through at the caprail connection.

Towing Bars: The forward towing bar is an arched oak beam mounted athwartship aft of the boiler casing. It extends from bulwark to bulwark and is supported by two turned hardwood stanchions mounted on deck. The existing towing bar, or one very similar to it, was part of the vessel's original equipment, and served to keep the tow line clear of the aft deck furniture.

The arched beam has incipient rot at checks, but is salvageable. The port support post is checked deeply but not yet rotten. The starboard post is rotten at the top and at the base. The steel plates tying the posts to the arch are rusting. The oil and varnish finish on the forward tow bar and post is in good condition.

The aft towing bar is an arched oak beam mounted across the cap rails at the stern. There is a carved nameboard of piranha pine fastened to the towing bar. This towing bar also shows incipient rot, but is saveable. The nameboard is warped and the oak beam may be rotten along the faying surface to the nameboard.

Ventilators, Forward: On the foredeck around the galley skylight are five cowl ventilators, 5" diameter by 44" tall. They are frozen in their collars and cannot rotate, but are otherwise in fair good condition.

Also on the foredeck are two venturi-cone ventilators of the same diameter and height. Both are frozen and the cones are rusted through.

Ventilators, Aft: Around the saloon skylight are five cowl ventilators, 5" diameter by 44" tall. These ventilators are in good condition with only one being frozen.

Ventilators, Bridge Deck: Abaft the pilothouse are two cowl ventilators for the engine room, 12" diameter by 7'4" tall. Both are rusted through at mid-level and near the base. Neither can rotate. All ventilators should be fitted with

noods to prevent the ingress of rain water.

Scuppers: There are none forward as the bulwark planking stops 2" above the deck. Midship, there are scuppers, port and starboard, in line with the head bulkheads. These scuppers are crudely cut through the upper flange of the gunwale bar and sheer strake. This creates a notch in the sheer that weakens the hull.

Aft of the boiler casing, there are scuppers port and starboard which drain through the deck and discharge via a pipe to the side shell. Both scuppers have rusted through completely and have recently been repaired, though with questionable effectiveness. Any leakage of the scupper pipes drains into the engine room bilge.

Aft of bulwark stay no. 4 there are scuppers cut through the gunwale bar above the deck level. These are 1" x 3" slots which, fortunately, do not sever the top of the flange of the sheer strake.

Aft, alongside the tow bar, there are 1" scupper holes drilled through the gunwale bar and sheer strake port and starboard.

Boats: The two ship's boats have been removed to museum storage in the Hastlett Warehouse. These include a double-ended lifeboat and a transom-sterned dingy. Both boats are lapstrake wood construction. Neither of the boats are believed to bear any historical relationship to EPPLETON HALL.

The life boat is only 12' long, yet stoutly built and fitted out with flotation tanks, side benches, and all the gear of a larger vessel's boats. Before being removed to protected storage, the lifeboat sat open to the weather for some years. Some joints have opened and rust is bleeding from numerous fastenings. The boat appears generally intact, but is not seaworthy.

The dingy of equally stout build and in better condition, having been in the water and in use in recent years.

Boat Davits: There are currently single radial davits outboard of the boat decks, port and starboard (originally the vessel was fitted with a pair of smaller davits for each boat). The davits rest on the sponsons and are bracketed off of the steel deckhouses abaft the paddleboxes. The davits are forged solid bar, 3-1/2" in diameter. They and in fair condition, but are mildly pitted and appear frozen in their sockets.

The blocks and falls for the boats have been removed, and the port davit is being used to support the electrical cable for the shore power. The davit guy wires are corroding and in need of coating or replacement.

Flagstaffs: One forward and one aft, both rotten at bases.

Access Ladders: The following is a listing of the various acc ladders and aboard the vessel.

1) Main deck to forward accommodations: made of Iroko, nin treads, all rotten between the joint and the stringer. This stair is unsafe and should be renewed.

2) Main deck to engine room: steel, 11 treads, not bolted in place but otherwise sound, light surface rust only.

3) Forward, port paddlebox: built onto exterior of box and follows the arc of the box. Wood treads on flat bar stringer supports. Of seven treads, three are missing and the rest rotten. The steel supports are either broken or nearly wasted through.

4) Forward, starboard paddlebox: Same construction as port, but only six treads, five of which are missing and the remaining one rotten. The steel supports are broken in four places.

5) Aft, port paddlebox: Same construction, but eight treads, all rotten. The top tread is adrift of its fastenings; others are in place but unsafe.

6) Aft, starboard paddlebox: Same construction, but six treads: three missing and three rotten. The steel supports are severely corroded.

7) Port bridge deck ladder: made of Iroko, with nine treads. There are no tie rods and the joints between the stringers and treads are opening up at the top of the ladder; otherwise sound.

8) Starboard bridge deck ladder: same construction as port. Lowest tread is rotten on outboard side.

9) Bridge deck to pilothouse roof: made of Iroko, nine treads; in good condition.

10) Aft end of fidley down to engine room: steel, eleven treads; in good condition.

11) Main deck to aft accommodations: made of Iroko, nine treads. Fourth tread from top is getting soft along its forward edge; otherwise sound.

3-2.26. Piping Systems and Sea Valves

Description: The piping systems include the bilge and fire system, the fuel system, the feed water and condenser water

piping to the boilers and engines, and the steam piping
steam piping is covered along with the boilers in sectio
1.20.).

The fuel system was installed when the boilers were conve
from coal to diesel in 1969. It consists of piping from th
fuel tanks to the diesel-powered fuel pumps aft of the
engines, and from the pumps to the burners at the front of
the boilers. The fuel system has two duplex strainers and
numerous valves.

Bilge and fire system includes a duplex steam pump that was
formerly connected to bilge suctions and a sea water suction
Sea water is taken from a thru-hull in the bottom and
filtered through a duplex sea water strainer. The system
pumped the engine room bilges and supplied sea water to two
fire stations on the main deck.

There are sea valves and piping for blowing down boilers, and
for supplying fresh feed water for the boilers and cooling
water for the jet condensers.

The following is a list of all thru-hull valves.

1) Blowdown for port boiler: 4" bronze sea cock, port side, D
strake, frames 29-30,

2) Blowdown for starboard boiler: 4" bronze sea cock, starboard
side, D strake, frames 29-30

3) Feed and condenser water: 3" or 4" bronze sea cock, port
side, C strake, frames 30-31

4) Feed and condenser water: 3" or 4" bronze sea cock,
starboard side, C strake, frames 30-31

5) Fire system sea suction: 2-1/2" (approx.) bronze valve,
port bottom, B strake, frames 43-44.

Condition: Portions of the fuel system were in operation as late
as 1979, but the system has been inactive since. The piping
appears mostly intact, but the pumps and burners are no
longer operable.

The bilge and fire system piping is badly corroded and the
steam pump is damaged and has been disconnected from the
system. The sea suction valve is corroded, indicating
galvanic action between the bronze valve and the surrounding
steel hull plating. The valve handle is missing.

The boiler blow down valves and piping are intact but
corroding. The thru-hull valves for condenser and feed water
are also intact but show signs of galvanic corrosion. The
handle is missing from the starboard valve. No attempt was
made to turn any of the sea valves.

Conclusions: None of the piping systems are operable and none critical to maintenance or safety.

The fuel piping system is a nonhistoric addition that is useless given that the boilers have been condemned. Removal of the fuel piping, along with the fuel tanks and pumps, is recommended in order to clear out the engine room and facilitate preservation of historic fabric.

The bilge and fire system may contain historic fabric. It should therefore be preserved. The condition of the sea suction valve for the fire system is of immediate concern; galvanic corrosion may result in serious leakage. This valve should be overhauled and properly remounted at the next drydocking, or removed and the thru-hull opening blanked off. The sea water strainer should be properly preserved, both inside and out.

The piping and sea valves associated with the boilers and engines are historic fabric and should be preserved. Valves will need to be overhauled at the next drydocking. Piping should be flushed with fresh water and an anti-corrosive coating applied inside and out.

3-2.27. Electrical System

Description: The existing electrical system postdates the historic period and includes a shipboard system installed in 1969, and additions made during NPS ownership. A distribution panel with six circuit breakers was installed in 1988 and connected to existing wiring in the engine room and the forward accommodations.

Condition: Most of the electrical system is deficient, either due to deterioration or substandard workmanship and materials. The main distribution panel is in good condition, but is not marine-type equipment and is vulnerable to moisture damage. The wiring and fixtures in the engine room are in marginal condition and most circuits are still usable, while much of the wiring in the forward and aft accommodations has deteriorated due to the leaking main deck and is presently unsafe.

Conclusions: Any major work aboard the vessel will require upgrading the electrical system. As it now stands, the system presents a safety hazard and does not provide sufficient lighting and service outlets to carry out preservation work. Marine-grade materials should be used for any additions or repairs to the system, and ground fault circuit interrupters (GFCI's) are recommended for all circuits having service outlets.

2.28. Table of Ultrasonic Hull Measurements

The thickness of EPPLETON HALL's hull and bulkhead plating was measured while she was afloat at the Hyde Street Pier in March 1 Measurements were taken from inside the hull using a digital ultrasonic caliper. Readings are in thousandths of an inch. Orig: plate thickness is taken from the midship section drawing by Hepp and Co., Ltd., her builders (no date given). The percentages give the right hand column represent the amount of material lost to corrosion.

Frame No.	Strake	Original Thickness	Present Thickness	Percentage Wastage
Forward Accommodations (frame 47-58)				
Port				
47-48	C	313	237, 261	24
47-48	D	375	201	46
47-48	E (sheer)	375	343	9
53-54	D	313	299	4
53-54	E (sheer)	313	311	1
55-56	A (garboard)	375	165	56
55-56	B	313	209, 274	23
55-56	C	313	246	21
Starboard				
48-49	D	375	322	14
49-50	C	313	276	12
49-50	D	375	320	15
53-54	D	313	160, 259	33
53-54	E (sheer)	313	222	29
55-56	A (garboard)	375	167	55
55-56	B	313	239, 204	29
55-56	C	313	236, 196	26
Engine Room (frame 14-47)				
Port				
29-30	C	313	218	30
38-39	C	313	276	12
38-39	D	375	267	29

Frame No.	Strake	Original Thickness	Present Thickness	Percentage Wastage
Engine Room (cont.)				
Port				
17-18	C	313	298, 309	4
17-18	D	375	334	11
17-18	E (sheer)	375	409	109*
42-43	C	313	239	24
42-43	D	375	188	50
Starboard				
16-17	D	375	272	27
17-18	D	375	352, 315	11
17-18	D	375	237 (in pit)	37
17-18	E (sheer)	375	405	108*
29-30	D	375	300, 346	14
29-30	E (sheer)	375	444	118*
30-31	C	313	180	42
30-31	D	375	346	8
30-31	E (sheer)	375	452	121*
38-39	C	313	226, 279	19
38-39	D	375	331	12
42-43	E (sheer)	375	469	125*
43-44	D	375	336, 327	12
Aft Accommodations (frame 0-14)				
Port				
0-1	C	313	206	34
1-2	C	313	280	11
2-3	C	313	193	38
3-4	C	313	234	25
4-5	C	313	262, 230	21
5-6	B	313	227	27
5-6	C	313	270	14
7-8	A	375	304	18
7-8	B	313	295	6
7-8	C	313	200, 275	23
7-8	D	313	246, 253	20
7-8	E (sheer)	313	299	4

* Renewed section of sheer strake, probably 1/2" (.500) plate

Frame No.	Strake	Original Thickness	Present Thickness	Percentage Wastage
Aft Accommodations (cont.)				
Port				
8-9	A	375	255	32
9-10	A	375	330	12
9-10	B	313	246	21
9-10	C	313	267, 219	23
Starboard				
0-1	C	313	119	62
1-2	C	313	193	38
5-6	B	313	214	32
7-8	A	375	276	26
7-8	B	313	250	20
7-8	C	313	236	25
7-8	D	313	195, 178	40
7-8	E	313	299	4
9-10	A	375	319	15
9-10	B	313	186	41
9-10	C	313	255	19
13-14	A	375	305	19
13-14	B	313	299	4

Average Wastage for all Shell Plating = 24 percent

3-3. Boiler Inspection Report

by Hartford Steam Boiler Inspection and Insurance Company

THE HARTFORD STEAM BOILER
INSPECTION and INSURANCE COMPANY
HARTFORD • CONNECTICUT 06102

SAN FRANCISCO BRANCH — 2785 MITCHELL DRIVE, SUITE 200, WALNUT CREEK, CA 94598 — (415) 944-1895

March 31, 1983

Department of the Interior
National Park Service
Golden Gate National Recreation Area
Fort Mason, Bldg. #201
San Francisco, CA. 94123

USED EQUIPMENT INSPECTION REPORT

Location: Eppleton Hall Tug, Pacific Dry Dock #1,
16th Street, Oakland, CA.

Two Fired Scotch Marine Boilers
Manufacturer - Riley Boiler Limited Co.
30 psi
Heating Surface - 400 Sq. Ft.
Year Built - 1945

A used equipment inspection was requested by Mr. Hastings, of the Department of the Interior National Park Service for the Objects located as indicated above and was examined by Inspector D. Spengler on 3-01-83 and 3-10-83.

This report is based upon inspection of those parts that were excessable. There were other parts that could not be examined at this time. Hidden defects are apt to emerge when and if an Object is subjected to new operating conditions.

Mr. Dave Courtois and Mr. Lorne E. Gould both Marine Inspectors from the U.S. Coast Guard and Mr. Steven W. Hastings from the National Maritime Museum of San Francisco, were present at the time of this inspection.

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PAST HISTORY

Two (2) boilers are installed side by side aboard the Eppleton Hall, a side paddle wheel tug. They were built in England by Riley Boiler Limited Co. in 1945. They are Scotch Marine type boilers, built originally for a maximum working pressure of 45 psi. On a later date, the working pressure was lowered to 40 psi, there is 400 sq ft of heating surface per boiler. The boiler shells are made of 5/8" plate and the furnace walls of 7/16" plate. Each boiler has one (1) furnace tube and one (1) return gas flue.

The boilers were originally built to be fired by the use of coal. They have been converted to be fired by the use of oil. The date of the conversion was not known at this time of inspection. This tug has laid half submerged in the Thames River in England for two and half years. The boilers were submerged 50% in brackish water. It was raised from the river and put back into operating status. The tug was brought to the United States under its own power in 1970. At a later date it was brought from San Francisco to the Pacific Dry Dock for maintenance and inspection. To our knowledge these boilers have not been operated in several years. These boilers have the following appurtenance and safety devices installed:

(1) Forced air draft oil burners, manufactures are unknown.

(2) One sight glass and water column for each boiler.

(3) One safety valve for each boiler set for 30 psi, manufactures are unknown.

(4) Fusible plugs on the fire sides.

When in operation, a boiler operator has to be present at all times.

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EXTERNAL INSPECTION STARBOARD BOILER #1

The external inspection revealed there are areas of the furnace tube that are distorted. There is a hole completely through the tube sheet into the water side. At the rear of the furnace tube sheet there are threaded stay bolts that show signs of corrosive pitting around the nuts.

Ultrasonic tests were taken at several points on the furnace tube sheet, the original thickness of furnace tube sheet is .4375 inches. Test showed in a range of .406 to .410 inches. This test result is not allowing for an amount of corrosion that maybe on the inaccessible side, a 7% to 10% estimated amount of corrosion to the furnace tube wall.

INTERNAL INSPECTION STARBOARD BOILER #1

The internal inspection indicated a great amount of sludge, corrosive rust, and scale was present in the lower half of the water sides, on the upper half, three (3) stays are heavily corroded and would have to be replace, of the 52 total stay bolts, an estimated 30% are so badly deteriorated that they would have to be replaced. Ultrasonic tests were made on the shell front lower end. The original shell thickness is .625 inches. Test showed readings of .444 and .358 inches which indicates an estimated corrosion factor of 29% to 43%. There was also a repair patch noticed at the bottom front part of the shell.

EXTERNAL INSPECTION PORT BOILER #2

The internal inspection indicated the front half of the furnace tube has several large bulges on both sides of the tube. The fire chamber at the rear of the furnace tube has been patched at one time. The metal is corroded away around several stay bolts. Around the stay bolt there is a hole completely through the plate into the water sides.

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INTERNAL INSPECTION PORT BOILER #2

The internal inspection indicated a great amount of sludge, corrosive rust and scale is present in the bottom of the shell. The through stays on the water sides are badly corroded and some will have to be replaced. Of the 52 stay bolts in this boiler an estimated 70% are so badly deteriorated that they would have to be replaced. Ultrasonic test were taken at the bottom front of the shell. This boiler has a support plate on the bottom side. The combined thickness of these two (2) plates are 1.25 inches. Test showed readings of .610" and .594". There were only two tests made on each boiler due to the restricted access. Considering both the thickness of the support plate and shell plate this would indicate an estimated 45% to 50% of corrosion factor.

Prior to these boilers being returned to operational status the following should be completed:

(1) All external and internal surfaces should be cleaned, all corrosive rust and scale scraped of exterior sides and more thickness tests should be made on the shell especially on the lower half.

(2) Oil burners would have to be rebuilt or replaced.

(3) Safety valves removed, overhauled and calibrated to the correct settings. Also, valve mounts should be cleaned and the metal checked around them.

(4) The bulges in the front half of the furnace tube should be carefully heated and set back to the original curvature of the tube. This work should be done under the supervision of a competent boiler maker.

(5) All stays and stay bolts are corrorded to such an extent, they should be replaced.

(6) Since your boilers are automatically fired it is recommended that the fuseable plugs be removed and solid plugs be inserted in there place.

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SAN FRANCISCO BRANCH — 2785 MITCHELL DRIVE, SUITE 200, WALNUT CREEK, CA 94598 — (415) 944-1895

SUMMARY

It seems that the port boiler is in a much more need of repairs than the Starboard boiler. Although both boilers are in very poor condition, it is possible that these boilers could be repaired and returned to an operating status, but only at a very high cost. The protective controls and auxilaries will have to be thoroughly cleaned and checked to determine if they warrent further use or need to be repaired or replaced. All automatic controls and safety devices used in conjunction with this boiler should be tested at least once each day. These tests should be made by a competent person and a record of the results maintained. If any part of the equipment proves to be defective, the boiler should immediately be removed from service until all of the necessary repairs have been made. The company assumes no liability with respect to any Object referred to in this report except such liability as maybe provided in a policy of insurance this company may issue upon said Objects and then only in accordance with terms said policy.

Yours very truly,

L. Osborne

L. Osborne
Supervising Inspector

LO/dm

3-4. National Register of Historic Places Inventory Nomination Form and Determination of Eligibility Notification

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR FEDERAL PROPERTIES

FOR NPS USE ONLY
RECEIVED JUN 11 1979
DATE ENTERED

SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

HISTORIC: Eppleton Hall

AND/OR COMMON: Steam Side Paddlewheel Tugboat Eppleton Hall

2 LOCATION

STREET & NUMBER: Vicinity of Pier 39 — NOT FOR PUBLICATION

CITY, TOWN: San Francisco — X VICINITY OF — CONGRESSIONAL DISTRICT: 5th

STATE: California — CODE: 06 — COUNTY: San Francisco — CODE: 075

3 CLASSIFICATION

CATEGORY	OWNERSHIP	STATUS	PRESENT USE	
__DISTRICT	__PUBLIC	__OCCUPIED	__AGRICULTURE	__MUSEUM
__BUILDING(S)	X PRIVATE	X UNOCCUPIED	__COMMERCIAL	__PARK
__STRUCTURE	__BOTH	__WORK IN PROGRESS	__EDUCATIONAL	__PRIVATE RESIDE
__SITE	**PUBLIC ACQUISITION**	**ACCESSIBLE**	__ENTERTAINMENT	__RELIGIOUS
X OBJECT	__IN PROCESS	__YES: RESTRICTED	__GOVERNMENT	__SCIENTIFIC
	__BEING CONSIDERED	__YES: UNRESTRICTED	__INDUSTRIAL	X TRANSPORTATIC
		__NO	__MILITARY	__OTHER:

4 AGENCY

REGIONAL HEADQUARTERS: *(If applicable)*
National Park Service, Western Regional Office

STREET & NUMBER: 450 Golden Gate Avenue, Box 36063

CITY, TOWN: San Francisco — ___ VICINITY OF — STATE: California 94102

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC.: San Francisco Maritime Museum Association

STREET & NUMBER: Polk and Beach Streets

CITY, TOWN: San Francisco — STATE: California

6 REPRESENTATION IN EXISTING SURVEYS

TITLE: None

DATE: — __FEDERAL __STATE __COUNTY __LOCAL

DEPOSITORY FOR SURVEY RECORDS

CITY, TOWN — STATE

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
_EXCELLENT	_DETERIORATED	_UNALTERED	_ORIGINAL SITE
X GOOD	_RUINS	X ALTERED	X MOVED DATE_____
_FAIR	_UNEXPOSED		

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

The Steam Side Paddlewheel Tugboat Eppleton Hall is a steel hulled, single-decked vessel of approximately 166 tons gross. Her dimensions are 100 feet by 21 feet at the center by 11 feet at the stern and bow, and her beam at the side paddle boxes measures 33 feet and 3 inches. She draws 10 feet of water. As built, she was equipped with a fore and aft cabin and an above deck iron engine room with a single funnel. She was fitted with a foremast which could be rigged for sail if her engines failed. Her decks were wood, as were her fittings and the pilot house, and she was originally painted red and black.

The engines are steam-driven side-lever "grasshopper" jet-condensed engines, with a 30-inch diameter cylinder, 51-inch stroke and two boilers with a common flue. The term "grasshopper" engine was a pragmatic description of the manner in which the engine worked. "They consisted, basically, of a large steam cylinder which rocked a long, heavy pair of levers on each side at the bottom of the cylinder in an up and down motion and these crude levers, in turn, were attached to large connecting rods that, again in turn, transferred the reciprocating, up and down motion to a main crankshaft, where it was transformed into a circular motion that directly turned the paddlewheels." There were two of these engines, side by side, and each powered a separate paddlewheel. This meant that the boat could easily be maneuvered. For example, to quickly turn the tug, one engine, perhaps the port engine, could idle while the starboard engine operated, turning only the starboard paddle and quickly turning the ship hard to port.

The engines of the Eppleton Hall are of a standard (but now rare) type used on many steam powered vessels in Great Britain, the United States and the world. Based on an 1804 patent British steam engine, the side lever "grasshopper" engine was in use throughout the world well into the Twentieth Century. The boilers utilize salt water, which is unusual and requires a constant program of "scaling" the salt deposits from the inside of the boiler. This, however, eliminates the need for bulky fresh water storage tanks. Historically, the engines were fired with coal, but were converted to diesel in 1970.

Following her consignment to a scrapyard in 1968, the Eppleton Hall was partially dismantled. According to those who saw her at that time, "the hull was in one piece, as were the iron engine room deck house and funnel. The ship, however, had been completely disemboweled. All the woodwork had been burned out, preparatory to cutting the vessel apart. The deck frames were warped. The paddle floats and paddle boxes had been either rotted or burned. The engines were covered with scum and rust, but were vaguely intact. And the Eppleton Hall's bottom was full of water."[1] The vessel, quite simply, was a "burned out, water-filled, rusty hulk. . ."[2]

After being purchased by the San Francisco Maritime Museum Association in England in 1969, the vessel was removed from the scrapyard and a restoration of the ship was begun. Basically, the vessel required "new decks, new hatches, new ladders, a new pilot house, a wheel. . . new bulwarks, new watertight doors, new deck frames, extra bracing, and stronger bulkheads. . . all fittings had to be cleaned and tested. . . new masts were (also) on the wanted list."[3] At this time, the Eppleton Hall was converted from coal to diesel fuel and fuel tanks and oil burners were installed.

The engines were "completely stripped down, cleaned, new pistol rings installed, and bearings refitted. . . the boilers. . . inspected and any thin or fractured plates replaced. . . the hull plating. . . subjected to tests and defective areas. . . croppe out and new plates riveted into place."[4] According to the published account of the work, it was necessary to transform a burned-out, fifty five year old rusted steel hull that had been originally designed and built for day work where the job required only a few hours' work in protected waters, at the most, into an ocean going vessel capable of threeto four week non-stop passages."[5] This "physical reconstruction"[6] of the vessel was basically completed by June of 1970 when "The engines had been reassembled and the work of rebuilding actually began. New paddle floats were install new paddle boxes built; new deck frames twice the strength of the original inland water crossmembers had been welded from one side to the other. The new diesel-fed oil burnerswere ready for fitting; and a massive steel plate, running from bow to stern, had been installed in order to stiffen the Eppleton Hall for her forthcoming deep sea passage."[7] Since the interior of the hull was bare, the engineers had to "design reasonably comfortable accomodations for twelve crew members."[8] In addition to the crew accomodations, the workers had to "scrounge ladders, gratings, portholes, a bridge deck pilot house, compass binnacles, anchors and chain, and other endless maritime items from among the mass of waterfront warrens along the edge of the river. And above all, everything had to fit generally into the original layout of the Eppleton Hall when she was launched."[9] These orders for parts were filled with teak ladders from worn out North Atlantic trawlers; lifeboats that were being repaired by a boat builder further down the Tyne; sacks of blocks for running rigging; two anchors miles of manila rope and brick red nylon hawsers; deck gratings from an offshore retired fishing boat; and a beautiful teak wheelhouse. . . discovered. . . in some inland meadow. . . a magnificent mahogany steering wheel which had been handcrafted by the same shipwright who later built the wheel for the Mauritania. This, after some minor surgery. . . fitted the Eppleton Hall perfectly."[10]

It seems, after a careful reading of the account of the reconstruction of the Eppleton Hall, that the reconstruction was just a reconstruction which attempted to follow along the basic original lines and design of the vessel, but only in a general way that only approximated the original fabric and did not reproduce or restore it. The final reconstruction of the vessel was completed in September of 1970. At that time, she was fitted out for a major voyage across the Atlantic to her new home port in San Francisco. After a six month voyage, she was moored in San Francisco, and she now rides at anchor adjacent to the historic ship Balclutha. While still operable and in good condition, she is in need of repairs and cleaning. Her engines are in good condition, but need to be cleaned and the boilers have several minor leaks which have forced a reduction of operating steam pressure.

Footnotes:

1 Newhall, Eppleton Hall page 27

2 ibid. page 35

3 ibid. pages 49-50

4 ibid. page 49

5 ibid. page 50

6 ibid. page 49

7 ibid. page 53

8 ibid. page 49

9 ibid. page 52

10 ibid. page 53

8 SIGNIFICANCE

PERIOD	AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW				
__PREHISTORIC	__ARCHEOLOGY-PREHISTORIC	__COMMUNITY PLANNING	__LANDSCAPE ARCHITECTURE	__RELIGION	
__1400-1499	__ARCHEOLOGY-HISTORIC	__CONSERVATION	__LAW	__SCIENCE	
__1500-1599	__AGRICULTURE	__ECONOMICS	__LITERATURE	__SCULPTURE	
__1600-1699	__ARCHITECTURE	__EDUCATION	__MILITARY	__SOCIAL/HUMANITARIA	
__1700-1799	__ART	X ENGINEERING	__MUSIC	__THEATER	
__1800-1899	X COMMERCE	__EXPLORATION/SETTLEMENT	__PHILOSOPHY	X TRANSPORTATION	
X 1900-	__COMMUNICATIONS	__INDUSTRY	__POLITICS/GOVERNMENT	__OTHER (SPECIFY)	
		__INVENTION			

SPECIFIC DATES 1914 BUILDER/ARCHITECT Hepple and Co. Ltd.

STATEMENT OF SIGNIFICANCE

The Steam Side Paddlewheel Tugboat Eppleton Hall was built in England in 1914 and is one of the last two tugs of this style and engine. Its engine is the once common but now rare side lever "grasshopper" engine and it is still operable. It was typical of tugs on the River Tyne and other streams and estuaries in England.

The above statement of significance is based on the following summary of the vessel's history.

Historical Summary

The first tugboats built on the River Tyne were constructed over 150 years ago. According to maritime historians, "during the centuries of ships. . . the awkwardness encountered in handling large deep water canvas powered vessels in the harbors of the world was passively accepted by mariners."[1] In 1814, in an attempt to correct the awkward difficulty, the first steam powered tug was built as the Tyne Steam Boat. Later rechristened the Perseverance, "she began towing the clumsy sailing vessels downriver and out past the breakwater to the open sea."[2] This small craft was supposedly the world's first tugboat.

In the years that followed, the shipyards on the banks of the Tyne turned out hundreds of the coal burning, steam powered tugs that operated on the Tyne and the other inland waters of the British Empire. The vessels on the Tyne "handled the square riggers and later the huge, power driven colliers that lumbered in and out of the river picking up their inevitable cargoes of coal."[3] The early vessels, with wooden hulls and single engines (which made maneuvering difficult) were replaced around 1850 with dual engines to drive twin paddlewheels. The maneuverability of the boat was thus doubled and the "Tyneside tugs became the most maneuverable vessels probably ever developed."[4] This particular design was not deviated from until well into the 20th century. The later tugs were reinforced with iron and steel for greater strength and durability, and "the Eppleton Hall was one of the last of these vessels to come off the ways. . ."[5]

The Eppleton Hall was built as Steel Paddle Tug #632 by the firm of Hepple and Co., Ltd., in South Shields (on the banks of the River Tyne) England. Commissioned in 1914, the Eppleton Hall was built for the Lambton Collieries Ltd. She received her name from the ancestral home of the Lambton family, Eppleton Hall. Used by the Lambton firm to tow coal carrying vessels down the River Wear in England to their designated landings, the Eppleton Hall was later sold to the English firm of France, Fenwick, Wear and Tyne Ltd., which was apparently another coal company and operated

on the River Tyne. Later the vessel was sold by the Fenwick group to the Seaham Harbo Dock Company, where she ended her working years continuing to ferry coal barges. By 1968, her working days were over and she was sold to a shipyard for scrap. There, she was partially gutted and left to rest as a rusted, burned-out, water-filled hulk for almost two years.

When the San Francisco Maritime Museum Association discovered that the vessel was one of the last two of her type, they purchased her remains in 1969 with the hope of resto her and sailing her across the Atlantic to San Francisco (see description block). Aft a lengthy reconstruction, she undertook a six month sea voyage to San Francisco where she was moored near Pier 38 and 39 in 1971.

Since then, the vessel has been largely dormant, with an occasional cruise on the Bay. She has a fine working example of a maritime steam engine of a new rare type. The last known, unaltered working example of the side-lever "grasshopper" engine and Tyne River Tug is the side Paddlewheel Tugboat Reliant, which was still operable as of 1969. That year it was decommissioned and is presently on display in the Maritime Museum of Greenwich, England.[6] The Eppleton Hall is the second example of this type of engine and tug and has been altered from the original design.

Footnotes:

[1]Newhall, page 15

[2]ibid. page 15

[3]ibid. page 16

[4]ibid, page 16

[5]ibid, pages 16-17

[6]Phone interview with Karl Kortum, Director, National Maritime Museum of San Francisco April 13, 1979.

NO. 11593

DETERMINATION OF ELIGIBILITY NOTIFICATION

National Register of Historic Places
Heritage Conservation and Recreation Service

Name of property: Eppleton Hall

Location: Pier 39, San Francisco, San Francisco County **State:** CA

Request submitted by: DOI/NPS/F. Ross Holland, Jr.

Date received: 6-11-79 **Additional information received:**

Opinion of the State Historic Preservation Officer:

☐ Eligible ☐ Not Eligible ☒ No Response

Comments:

The Secretary of the Interior has determined that this property is:

☐ Eligible **Applicable criteria:** ☒ Not Eligible

Comments: The vessel does not meet the National Register criteria. It has been in the United States only since 1968 and has no demonstrated significance in American history.

☐ Documentation insufficient
(Please see accompanying sheet explaining additional materials required)

Charles A

Keeper of the National Register

Date: AUG 10 [illegible]

FHR 8-265 2/79

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

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RECEIVED JUN 11 1979
DATE ENTERED

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